FCC PART 15.247

TEST REPORT

For

Roam Data Inc.

280 Summer St Boston, Massachusetts

FCC ID: 2ABY6-MOB30AA

Report Type:	**Product Type:**
Original Report	Mobile Payment Terminal

Test Engineer:	Lion Xiao
Report Number:	RXM160719050-00A
Report Date:	2016-08-02
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

TABLE OF CONTENTS

GENERAL INFORMATION **4**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 4
OBJECTIVE 4
RELATED SUBMITTAL(S)/GRANT(S) 4
TEST METHODOLOGY 4
TEST FACILITY 4
SYSTEM TEST CONFIGURATION **5**
DESCRIPTION OF TEST CONFIGURATION 5
EUT EXERCISE SOFTWARE 5
EQUIPMENT MODIFICATIONS 5
SUPPORT EQUIPMENT LIST AND DETAILS 5
EXTERNAL CABLE 5
BLOCK DIAGRAM OF TEST SETUP 5
SUMMARY OF TEST RESULTS **6**
FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE **7**
APPLICABLE STANDARD 7
FCC §15.203 - ANTENNA REQUIREMENT **8**
APPLICABLE STANDARD 8
ANTENNA CONNECTOR CONSTRUCTION 8
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS **9**
APPLICABLE STANDARD 9
MEASUREMENT UNCERTAINTY 9
EUT SETUP 9
EMI TEST RECEIVER SETUP 10
TEST PROCEDURE 10
CORRECTED AMPLITUDE & MARGIN CALCULATION 10
TEST EQUIPMENT LIST AND DETAILS 11
TEST RESULTS SUMMARY 11
TEST DATA 11
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS **14**
APPLICABLE STANDARD 14
MEASUREMENT UNCERTAINTY 14
EUT SETUP 14
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP 15
TEST PROCEDURE 15
TEST EQUIPMENT LIST AND DETAILS 16
CORRECTED AMPLITUDE & MARGIN CALCULATION 16
TEST RESULTS SUMMARY 16
TEST DATA 16
FCC §15.247(a) (1) - CHANNEL SEPARATION TEST **22**
APPLICABLE STANDARD 22
TEST EQUIPMENT LIST AND DETAILS 22
TEST PROCEDURE 22
TEST DATA 22

FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING 28
APPLICABLE STANDARD 28
TEST PROCEDURE 28
TEST EQUIPMENT LIST AND DETAILS 28
TEST DATA 28
FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST 34
APPLICABLE STANDARD 34
TEST PROCEDURE 34
TEST EQUIPMENT LIST AND DETAILS 34
TEST DATA 34
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME) 38
APPLICABLE STANDARD 38
TEST PROCEDURE 38
TEST EQUIPMENT LIST AND DETAILS 38
TEST DATA 38
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT 54
APPLICABLE STANDARD 54
TEST PROCEDURE 54
TEST EQUIPMENT LIST AND DETAILS 54
TEST DATA 54
FCC §15.247(d) - BAND EDGES TESTING 56
APPLICABLE STANDARD 56
TEST PROCEDURE 56
TEST EQUIPMENT LIST AND DETAILS 56
TEST DATA 56

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Roam Data Inc.*'s product, model number: *MOBY-3000 (FCC ID: 2ABY6-MOB30AA)* (the "EUT") in this report was a *Mobile Payment Terminal,* which was measured approximately: 7.7 cm (L) x 5.3 cm (W) x 1.3 cm (H), rated input voltage: DC 3.7V from chargeable battery or DC5V charging from USB port.

All measurement and test data in this report was gathered from production sample serial number: 160719050 (Assigned by BACL, Dongguan). The EUT was received on 2016-07-20.

Objective

This report is prepared on behalf of *Roam Data Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission's rules

The tests were performed in order to determine the Bluetooth BDR and EDR mode of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15C DTS submissions with FCC ID: 2ABY6-MOB30AA.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 06, 2015.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

EUT Exercise Software

Test software: Bluetooth MP Tool was used during testing for swith the test modes, the maximum power was configured by the system default value.

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

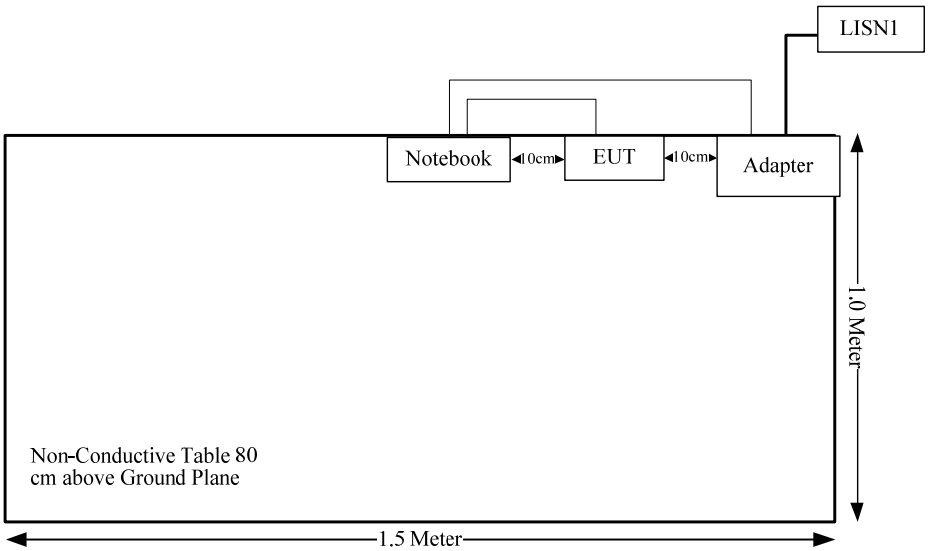
Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (cm)	From Port	To
USB Cable	no	no	50	Laptop	EUT

Block Diagram of Test Setup

AC power line conducted emissions:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(1)	20 dB Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

According to§15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v05r02:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

The max tune-up conducted power is 5.7dBm (3.72 mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
= 3.72/5*(√2.48) = 1.2 < 3.0

So the stand-alone SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has one integral antenna arrangement, which was permanently attached and the antenna gain is 1.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

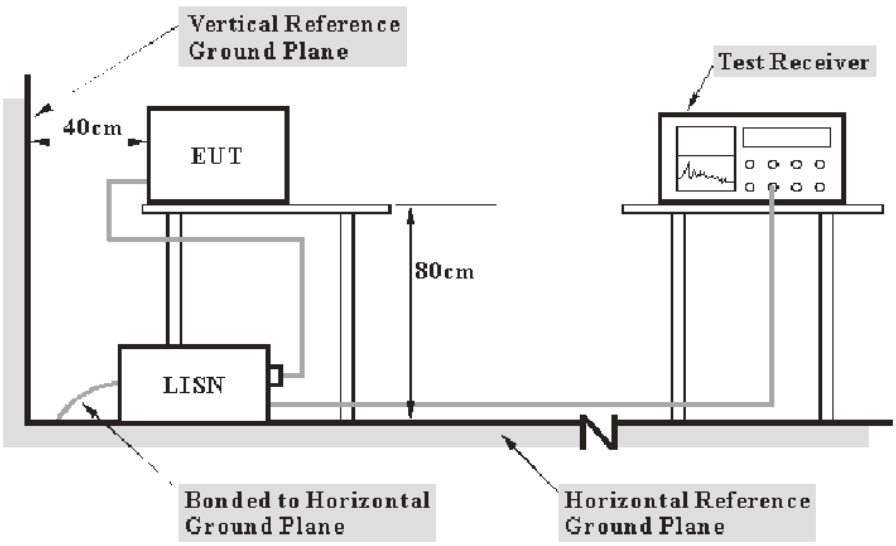
If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Dongguan) is 3.12 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter of laptop was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$

Herein,
V_C: corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN or ISN

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2015-12-10	2016-12-09
R&S	L.I.S.N	ESH2-Z5	892107/021	2016-07-16	2017-07-15
N/A	Coaxial Cable	1.8m	N/A	2016-05-06	2017-05-06
R&S	Two-line V-network	ENV 216	3560.6550.12	2015-11-26	2016-11-25
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, with the worst margin reading of:

14.8 dB at **0.340821 MHz** in the **Neutral** conducted mode

Test Data

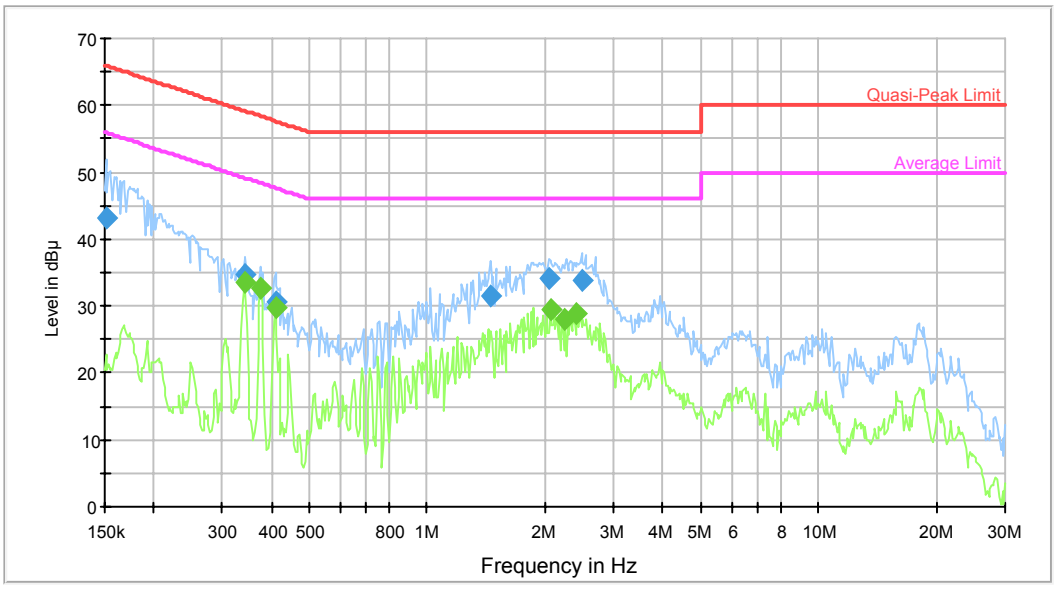
Environmental Conditions

Temperature:	29.5°C
Relative Humidity:	50 %
ATM Pressure:	100.2 kPa

The testing was performed by Lion Xiao on 2016-07-26.

Test Mode: Transmitting

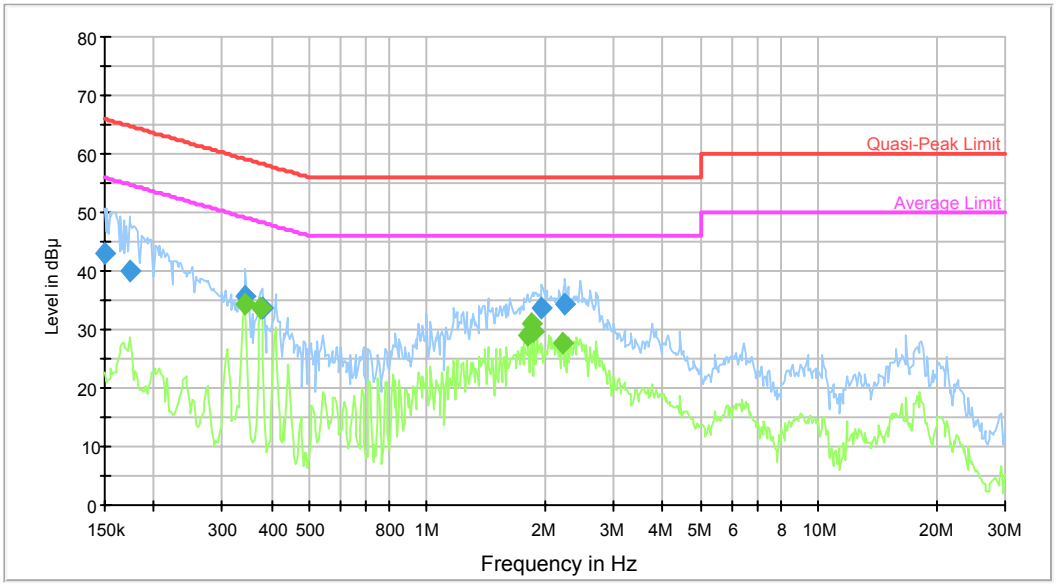
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.151200	43.1	9.000	L1	10.2	22.8	65.9	Compliance
0.343548	34.6	9.000	L1	10.3	24.5	59.1	Compliance
0.409372	30.5	9.000	L1	10.2	27.2	57.7	Compliance
1.453260	31.5	9.000	L1	10.4	24.5	56.0	Compliance
2.047133	34.2	9.000	L1	10.4	21.8	56.0	Compliance
2.478557	34.0	9.000	L1	10.4	22.0	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.340821	33.7	9.000	L1	10.3	15.5	49.2	Compliance
0.375019	32.5	9.000	L1	10.3	15.9	48.4	Compliance
0.409372	29.7	9.000	L1	10.2	18.0	47.7	Compliance
2.063510	29.5	9.000	L1	10.4	16.5	46.0	Compliance
2.252540	28.0	9.000	L1	10.4	18.0	46.0	Compliance
2.420011	28.9	9.000	L1	10.4	17.1	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.150000	43.1	9.000	N	10.2	22.9	66.0	Compliance
0.173134	39.9	9.000	N	10.1	24.9	64.8	Compliance
0.343548	35.7	9.000	N	10.3	23.4	59.1	Compliance
0.378019	33.6	9.000	N	10.2	24.7	58.3	Compliance
1.967177	33.6	9.000	N	10.4	22.4	56.0	Compliance
2.252540	34.5	9.000	N	10.4	21.5	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.340821	34.4	9.000	N	10.3	14.8	49.2	Compliance
0.375019	33.5	9.000	N	10.2	14.9	48.4	Compliance
1.816511	28.9	9.000	N	10.4	17.1	46.0	Compliance
1.845692	30.8	9.000	N	10.4	15.2	46.0	Compliance
1.875341	29.8	9.000	N	10.4	16.2	46.0	Compliance
2.216927	27.6	9.000	N	10.4	18.4	46.0	Compliance

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

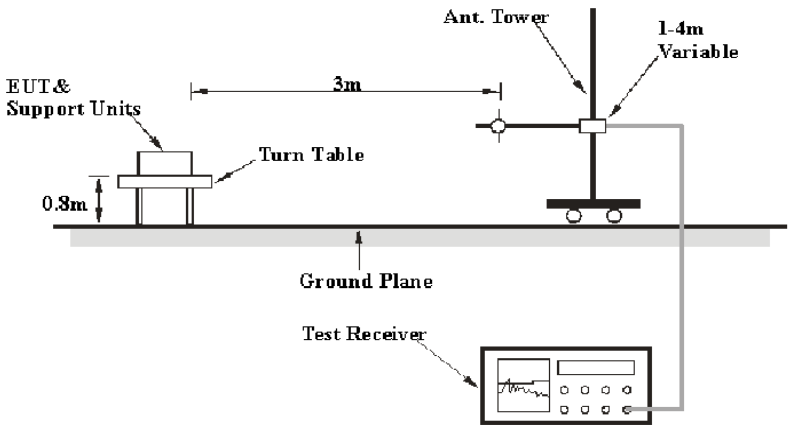
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical; 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical; 1G~6GHz: 4.45 dB, 6G~18GHz: 5.23 dB

Table 1 – Values of U_{cispr}

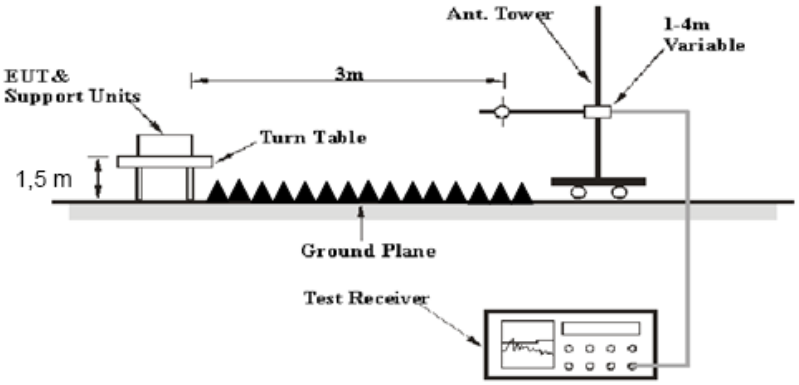
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2015-08-03	2016-08-02
Sunol Sciences	Antenna	JB3	A060611-3	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2015-09-01	2016-09-01
Agilent	Spectrum Analyzer	E4440A	SG43360054	2015-11-23	2016-11-22
ETS-Lindgren	Horn Antenna	3115	9808-5557	2015-09-06	2018-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2016-02-19	2017-02-19
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2014-06-16	2017-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2015-09-06	2016-09-06
N/A	Coaxial Cable	14m	N/A	2016-05-06	2017-05-06
N/A	Coaxial Cable	8m	N/A	2016-05-06	2017-05-06

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, and section 15.205, 15.209 and 15.247, with the worst margin reading of:

9.20 dB at **2390 MHz** in the **Horizontal** polarization

Test Data

Environmental Conditions

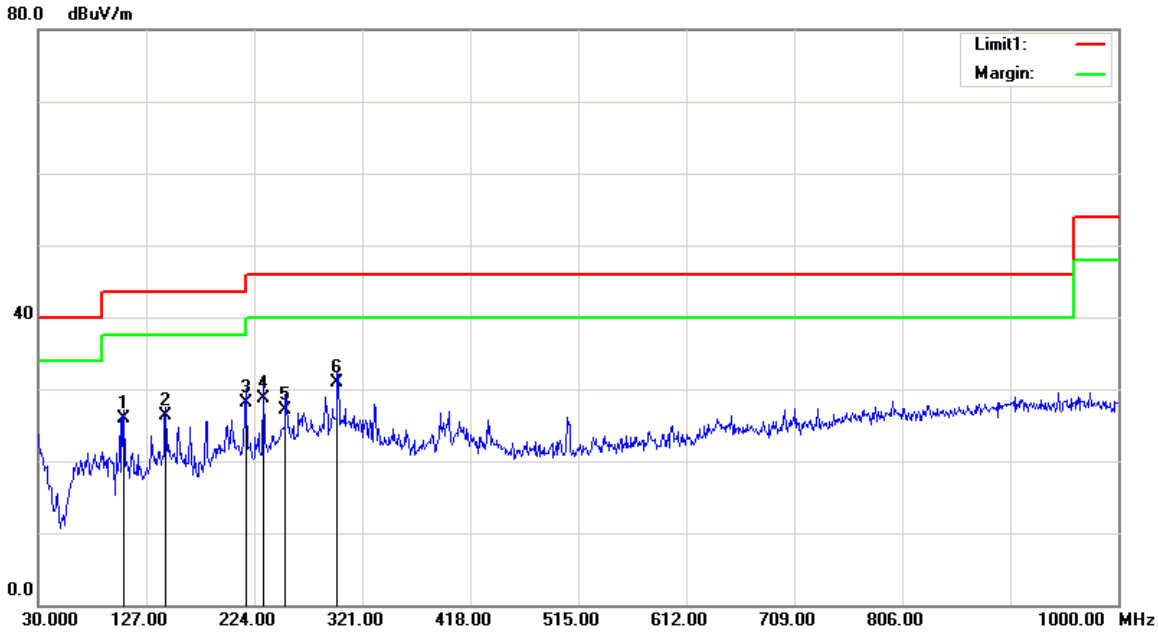
Temperature:	28.7°C
Relative Humidity:	68 %
ATM Pressure:	100.2 kPa

** The testing was performed by Lion Xiao on 2016-07-27.*

Test mode: Transmitting

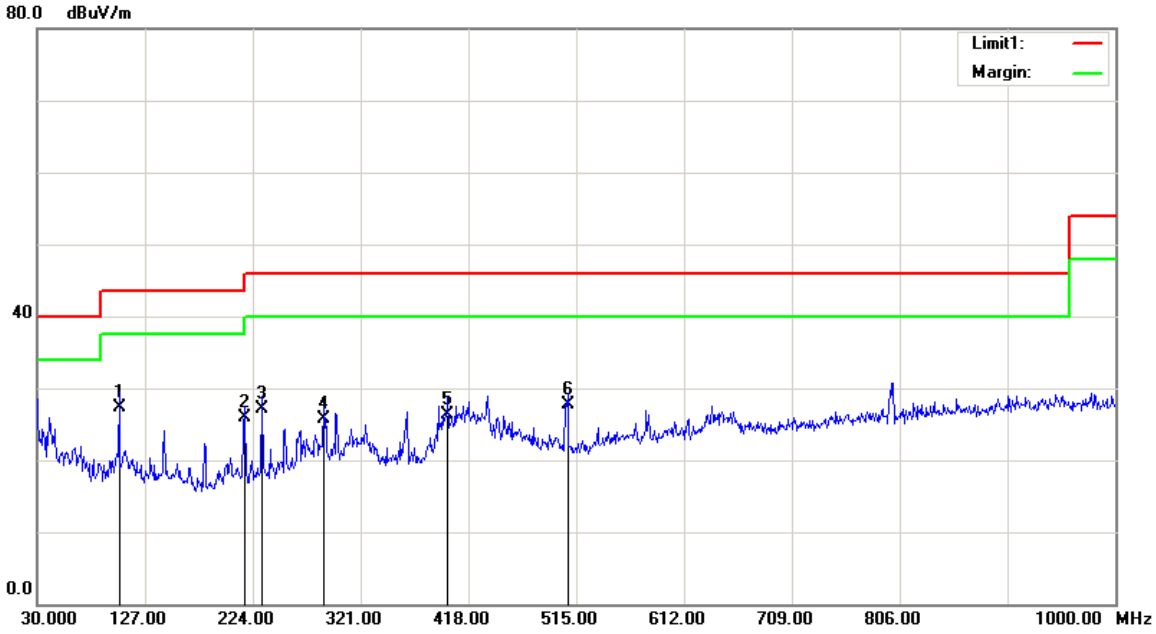
1) Below 1GHz *(BDR mode middle channel is the worst case)***:**

Horizontal:



Frequency (MHz)	Receiver Reading (dBµV)	Detector (PK/QP/Ave)	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
106.6300	33.80	QP	-7.90	25.90	43.50	17.60
144.4600	33.37	QP	-6.97	26.40	43.50	17.10
216.2400	36.99	QP	-8.89	28.10	46.00	17.90
231.7600	36.69	QP	-7.99	28.70	46.00	17.30
252.1300	34.93	QP	-7.73	27.20	46.00	18.80
298.6900	36.74	QP	-5.84	30.90	46.00	15.10

Vertical:



Frequency (MHz)	Receiver Reading (dBµV)	Detector (PK/QP/Ave)	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
103.7200	36.00	QP	-8.60	27.40	43.50	16.10
216.2400	34.79	QP	-8.89	25.90	46.00	20.10
231.7600	35.09	QP	-7.99	27.10	46.00	18.90
288.0200	31.70	QP	-5.90	25.80	46.00	20.20
399.5700	29.89	QP	-3.59	26.30	46.00	19.70
507.2400	29.25	QP	-1.55	27.70	46.00	18.30

2) 1G-25GHz:

BDR Mode (GFSK):

Frequency	Receiver		Rx Antenna		Cable	Amplifier	Corrected	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)	loss (dB)	Gain (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	68.71	PK	H	25.65	3.66	0.00	98.02	N/A	N/A
2402	58.25	AV	H	25.65	3.66	0.00	87.56	N/A	N/A
2402	65.67	PK	V	25.65	3.66	0.00	94.98	N/A	N/A
2402	55.73	AV	V	25.65	3.66	0.00	85.04	N/A	N/A
2390	29.16	PK	H	25.61	3.63	0.00	58.40	74.00	15.60
2390	14.60	AV	H	25.61	3.63	0.00	43.84	54.00	10.16
4804	41.16	PK	H	30.59	5.06	27.41	49.40	74.00	24.60
4804	35.60	AV	H	30.59	5.06	27.41	43.84	54.00	10.16
7206	36.64	PK	H	34.09	6.61	25.91	51.43	74.00	22.57
7206	28.15	AV	H	34.09	6.61	25.91	42.94	54.00	11.06
9608	32.11	PK	H	36.74	8.53	27.55	49.83	74.00	24.17
9608	20.10	AV	H	36.74	8.53	27.55	37.82	54.00	16.18
3131	40.96	PK	H	27.62	6.93	27.43	48.08	74.00	25.92
3131	28.53	AV	H	27.62	6.93	27.43	35.65	54.00	18.35
Middle Channel: 2441 MHz									
2441	67.15	PK	H	25.75	3.76	0.00	96.66	N/A	N/A
2441	57.72	AV	H	25.75	3.76	0.00	87.23	N/A	N/A
2441	64.77	PK	V	25.75	3.76	0.00	94.28	N/A	N/A
2441	54.13	AV	V	25.75	3.76	0.00	83.64	N/A	N/A
4882	40.79	PK	H	30.79	5.19	27.42	49.35	74.00	24.65
4882	34.66	AV	H	30.79	5.19	27.42	43.22	54.00	10.78
7323	36.53	PK	H	34.38	6.75	25.88	51.78	74.00	22.22
7323	28.13	AV	H	34.38	6.75	25.88	43.38	54.00	10.62
9764	30.36	PK	H	36.81	8.62	27.20	48.59	74.00	25.41
9764	18.90	AV	H	36.81	8.62	27.20	37.13	54.00	16.87
3131	40.19	PK	H	27.62	6.93	27.43	47.31	74.00	26.69
3131	28.20	AV	H	27.62	6.93	27.43	35.32	54.00	18.68
3190	37.26	PK	H	27.81	6.26	27.38	43.95	74.00	30.05
3190	25.57	AV	H	27.81	6.26	27.38	32.26	54.00	21.74
High Channel: 2480 MHz									
2480	66.70	PK	H	25.85	3.68	0.00	96.23	N/A	N/A
2480	56.74	AV	H	25.85	3.68	0.00	86.27	N/A	N/A
2480	63.81	PK	V	25.85	3.68	0.00	93.34	N/A	N/A
2480	53.98	AV	V	25.85	3.68	0.00	83.51	N/A	N/A
2483.5	28.57	PK	H	25.86	3.67	0.00	58.10	74.00	15.90
2483.5	14.78	AV	H	25.86	3.67	0.00	44.31	54.00	9.69
4960	40.71	PK	H	31.00	5.34	27.43	49.62	74.00	24.38
4960	34.39	AV	H	31.00	5.34	27.43	43.30	54.00	10.70
7440	35.33	PK	H	34.66	6.89	25.97	50.91	74.00	23.09
7440	27.21	AV	H	34.66	6.89	25.97	42.79	54.00	11.21
9920	32.87	PK	H	36.87	8.71	26.66	51.79	74.00	22.21
9920	20.92	AV	H	36.87	8.71	26.66	39.84	54.00	14.16
3131	40.79	PK	H	27.62	6.93	27.43	47.91	74.00	26.09
3131	28.34	AV	H	27.62	6.93	27.43	35.46	54.00	18.54

EDR Mode (π/4-DQPSK):

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	70.24	PK	H	25.65	3.66	0.00	99.55	N/A	N/A
2402	58.09	AV	H	25.65	3.66	0.00	87.40	N/A	N/A
2402	67.82	PK	V	25.65	3.66	0.00	97.13	N/A	N/A
2402	55.97	AV	V	25.65	3.66	0.00	85.28	N/A	N/A
2390	29.80	PK	H	25.61	3.63	0.00	59.04	74.00	14.96
2390	15.24	AV	H	25.61	3.63	0.00	44.48	54.00	9.52
4804	38.94	PK	H	30.59	5.06	27.41	47.18	74.00	26.82
4804	30.38	AV	H	30.59	5.06	27.41	38.62	54.00	15.38
7206	32.10	PK	H	34.09	6.61	25.91	46.89	74.00	27.11
7206	20.04	AV	H	34.09	6.61	25.91	34.83	54.00	19.17
9608	30.87	PK	H	36.74	8.53	27.55	48.59	74.00	25.41
9608	18.70	AV	H	36.74	8.53	27.55	36.42	54.00	17.58
3131	40.87	PK	H	27.62	6.93	27.43	47.99	74.00	26.01
3131	28.90	AV	H	27.62	6.93	27.43	36.02	54.00	17.98
Middle Channel: 2441 MHz									
2441	69.16	PK	H	25.75	3.76	0.00	98.67	N/A	N/A
2441	57.33	AV	H	25.75	3.76	0.00	86.84	N/A	N/A
2441	66.09	PK	V	25.75	3.76	0.00	95.60	N/A	N/A
2441	54.81	AV	V	25.75	3.76	0.00	84.32	N/A	N/A
4882	38.08	PK	H	30.79	5.19	27.42	46.64	74.00	27.36
4882	30.47	AV	H	30.79	5.19	27.42	39.03	54.00	14.97
7323	32.23	PK	H	34.38	6.75	25.88	47.48	74.00	26.52
7323	20.77	AV	H	34.38	6.75	25.88	36.02	54.00	17.98
9764	30.22	PK	H	36.81	8.62	27.20	48.45	74.00	25.55
9764	18.79	AV	H	36.81	8.62	27.20	37.02	54.00	16.98
3131	40.54	PK	H	27.62	6.93	27.43	47.66	74.00	26.34
3131	28.29	AV	H	27.62	6.93	27.43	35.41	54.00	18.59
3610	38.43	PK	H	29.04	4.61	27.28	44.80	74.00	29.20
3610	26.88	AV	H	29.04	4.61	27.28	33.25	54.00	20.75
High Channel: 2480 MHz									
2480	68.52	PK	H	25.85	3.68	0.00	98.05	N/A	N/A
2480	56.78	AV	H	25.85	3.68	0.00	86.31	N/A	N/A
2480	65.64	PK	V	25.85	3.68	0.00	95.17	N/A	N/A
2480	53.69	AV	V	25.85	3.68	0.00	83.22	N/A	N/A
2483.5	29.12	PK	H	25.86	3.67	0.00	58.65	74.00	15.35
2483.5	15.07	AV	H	25.86	3.67	0.00	44.60	54.00	9.40
4960	38.83	PK	H	31.00	5.34	27.43	47.74	74.00	26.26
4960	30.19	AV	H	31.00	5.34	27.43	39.10	54.00	14.90
7440	32.25	PK	H	34.66	6.89	25.97	47.83	74.00	26.17
7440	20.91	AV	H	34.66	6.89	25.97	36.49	54.00	17.51
9920	32.85	PK	H	36.87	8.71	26.66	51.77	74.00	22.23
9920	20.69	AV	H	36.87	8.71	26.66	39.61	54.00	14.39
3131	40.62	PK	H	27.62	6.93	27.43	47.74	74.00	26.26
3131	28.08	AV	H	27.62	6.93	27.43	35.20	54.00	18.80

EDR Mode (8-DPSK):

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	70.81	PK	H	25.65	3.66	0.00	100.12	N/A	N/A
2402	58.70	AV	H	25.65	3.66	0.00	88.01	N/A	N/A
2402	67.10	PK	V	25.65	3.66	0.00	96.41	N/A	N/A
2402	55.13	AV	V	25.65	3.66	0.00	84.44	N/A	N/A
2390	29.57	PK	H	25.61	3.63	0.00	58.81	74.00	15.19
2390	15.56	AV	H	25.61	3.63	0.00	44.80	54.00	9.20
4804	40.07	PK	H	30.59	5.06	27.41	48.31	74.00	25.69
4804	32.62	AV	H	30.59	5.06	27.41	40.86	54.00	13.14
7206	34.61	PK	H	34.09	6.61	25.91	49.40	74.00	24.60
7206	22.24	AV	H	34.09	6.61	25.91	37.03	54.00	16.97
9608	30.21	PK	H	36.74	8.53	27.55	47.93	74.00	26.07
9608	18.03	AV	H	36.74	8.53	27.55	35.75	54.00	18.25
3131	40.01	PK	H	27.62	6.93	27.43	47.13	74.00	26.87
3131	28.76	AV	H	27.62	6.93	27.43	35.88	54.00	18.12
Middle Channel: 2441 MHz									
2441	69.33	PK	H	25.75	3.76	0.00	98.84	N/A	N/A
2441	57.27	AV	H	25.75	3.76	0.00	86.78	N/A	N/A
2441	66.31	PK	V	25.75	3.76	0.00	95.82	N/A	N/A
2441	54.56	AV	V	25.75	3.76	0.00	84.07	N/A	N/A
4882	40.04	PK	H	30.79	5.19	27.42	48.60	74.00	25.40
4882	28.85	AV	H	30.79	5.19	27.42	37.41	54.00	16.59
7323	32.43	PK	H	34.38	6.75	25.88	47.68	74.00	26.32
7323	20.16	AV	H	34.38	6.75	25.88	35.41	54.00	18.59
9764	30.23	PK	H	36.81	8.62	27.20	48.46	74.00	25.54
9764	18.12	AV	H	36.81	8.62	27.20	36.35	54.00	17.65
3131	40.18	PK	H	27.62	6.93	27.43	47.30	74.00	26.70
3131	28.31	AV	H	27.62	6.93	27.43	35.43	54.00	18.57
3610	37.97	PK	H	29.04	4.61	27.28	44.34	74.00	29.66
3610	25.42	AV	H	29.04	4.61	27.28	31.79	54.00	22.21
High Channel: 2480 MHz									
2480	68.95	PK	H	25.85	3.68	0.00	98.48	N/A	N/A
2480	56.10	AV	H	25.85	3.68	0.00	85.63	N/A	N/A
2480	65.24	PK	V	25.85	3.68	0.00	94.77	N/A	N/A
2480	53.39	AV	V	25.85	3.68	0.00	82.92	N/A	N/A
2483.5	28.41	PK	H	25.86	3.67	0.00	57.94	74.00	16.06
2483.5	14.94	AV	H	25.86	3.67	0.00	44.47	54.00	9.53
4960	39.78	PK	H	31.00	5.34	27.43	48.69	74.00	25.31
4960	31.22	AV	H	31.00	5.34	27.43	40.13	54.00	13.87
7440	32.49	PK	H	34.66	6.89	25.97	48.07	74.00	25.93
7440	20.13	AV	H	34.66	6.89	25.97	35.71	54.00	18.29
9920	29.99	PK	H	36.87	8.71	26.66	48.91	74.00	25.09
9920	17.95	AV	H	36.87	8.71	26.66	36.87	54.00	17.13
3131	40.71	PK	H	27.62	6.93	27.43	47.83	74.00	26.17
3131	28.29	AV	H	27.62	6.93	27.43	35.41	54.00	18.59

FCC §15.247(a) (1) - CHANNEL SEPARATION TEST

Applicable Standard

Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	30.1°C
Relative Humidity:	53 %
ATM Pressure:	100.2 kPa

** The testing was performed by Lion Xiao on 2016-07-26.*

Test Result: Compliance.

Please refer to following tables and plots

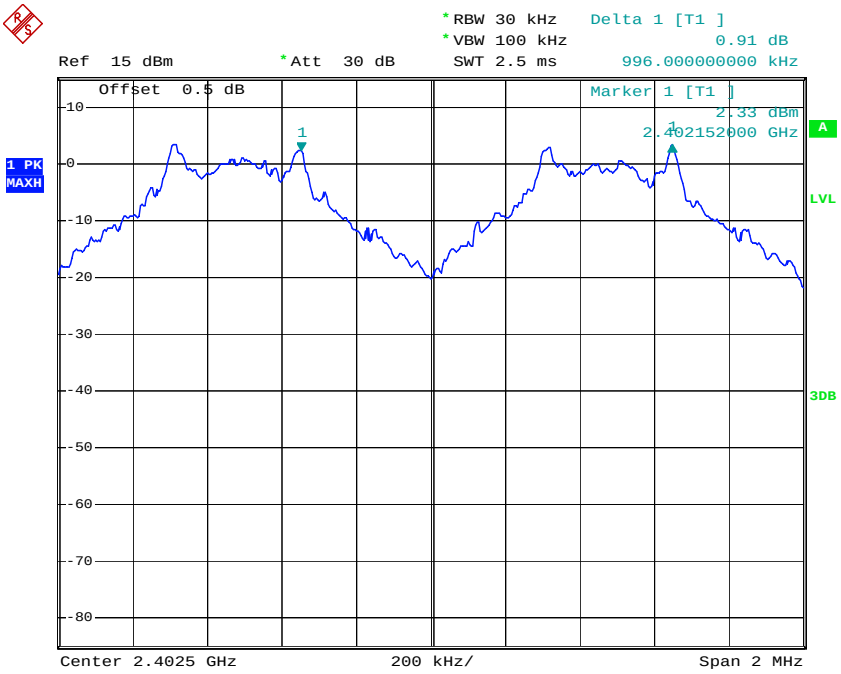
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
GFSK	Low	2402	0.996	0.624
	Middle	2441	1.004	0.600
	High	2480	1.004	0.592
π / 4 DQPSK	Low	2402	1.000	0.820
	Middle	2441	1.000	0.820
	High	2480	1.004	0.820
8DPSK	Low	2402	1.000	0.860
	Middle	2441	0.996	0.848
	High	2480	1.004	0.852

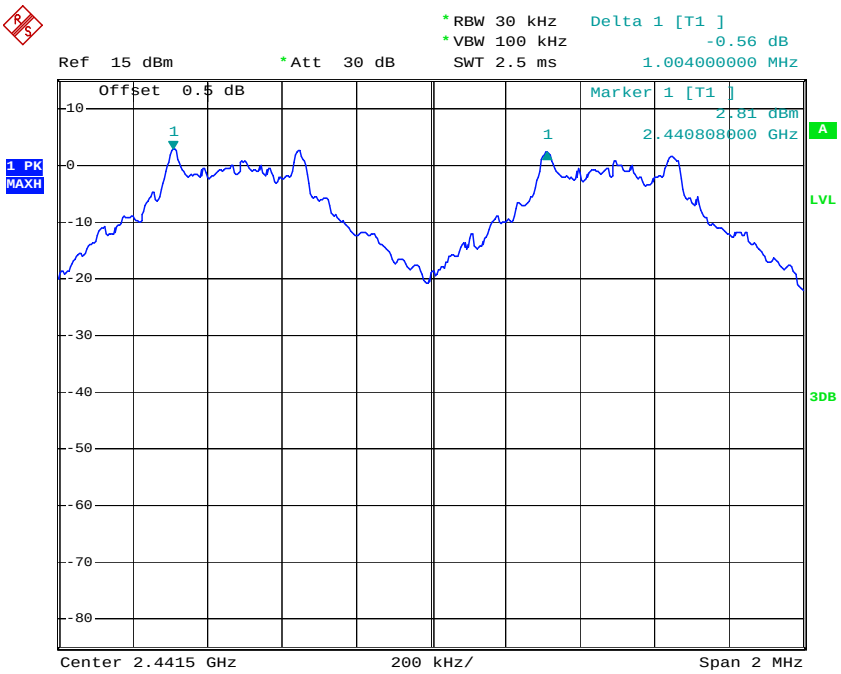
Note: Limit= (2/3)× 20dB bandwidth

BDR Mode (GFSK):

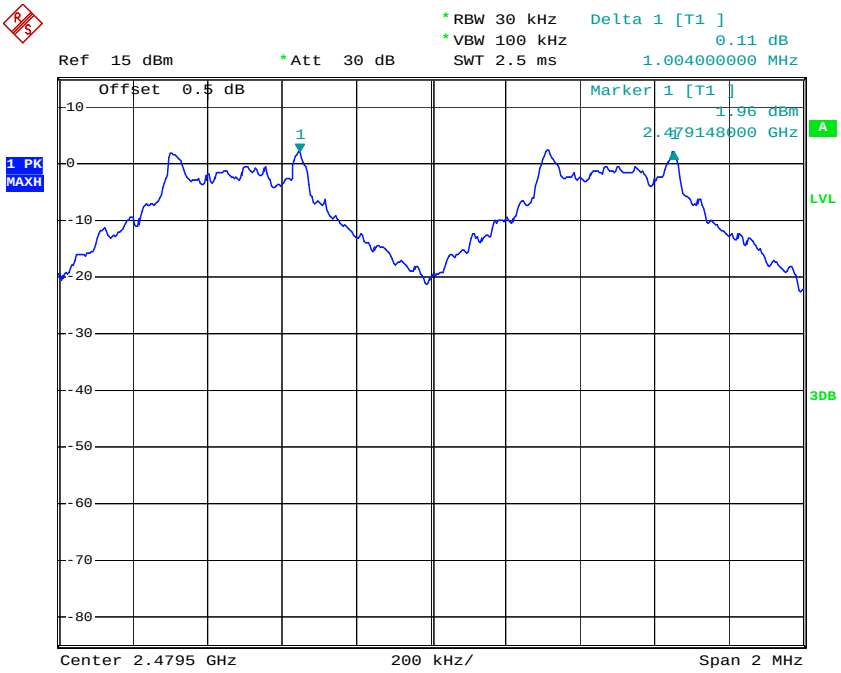
Low Channel



Middle Channel

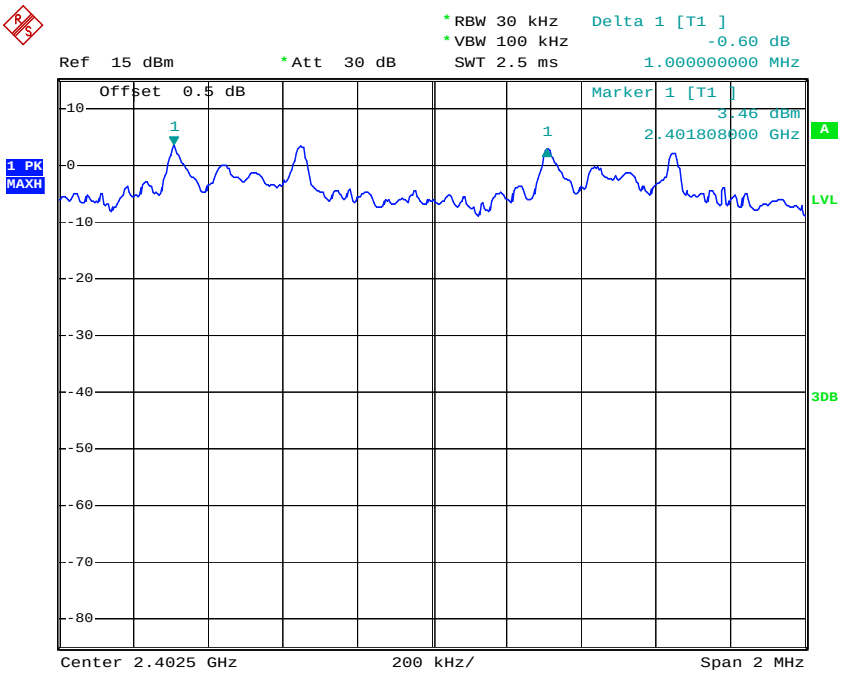


High Channel

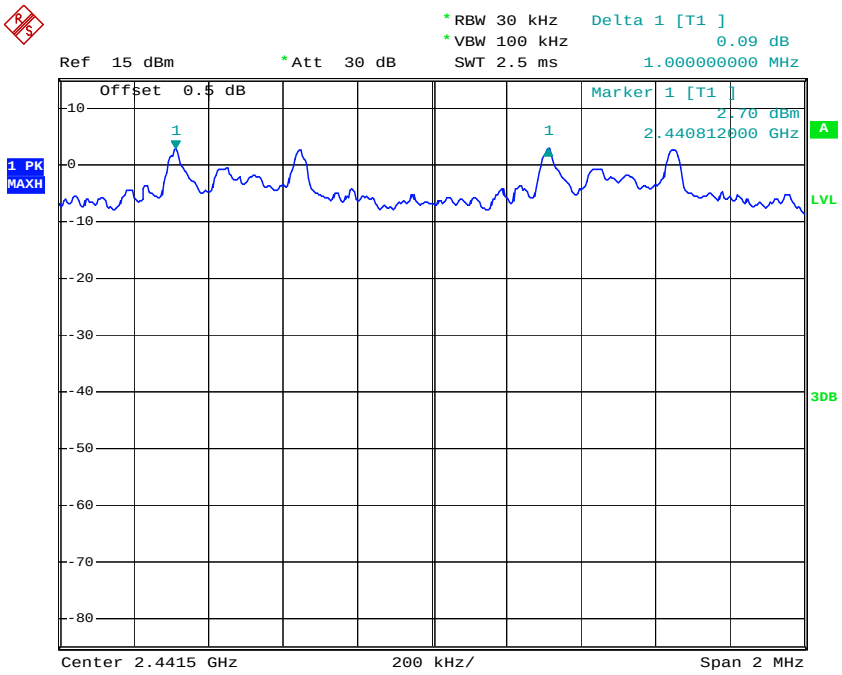


EDR Mode (π/4-DQPSK):

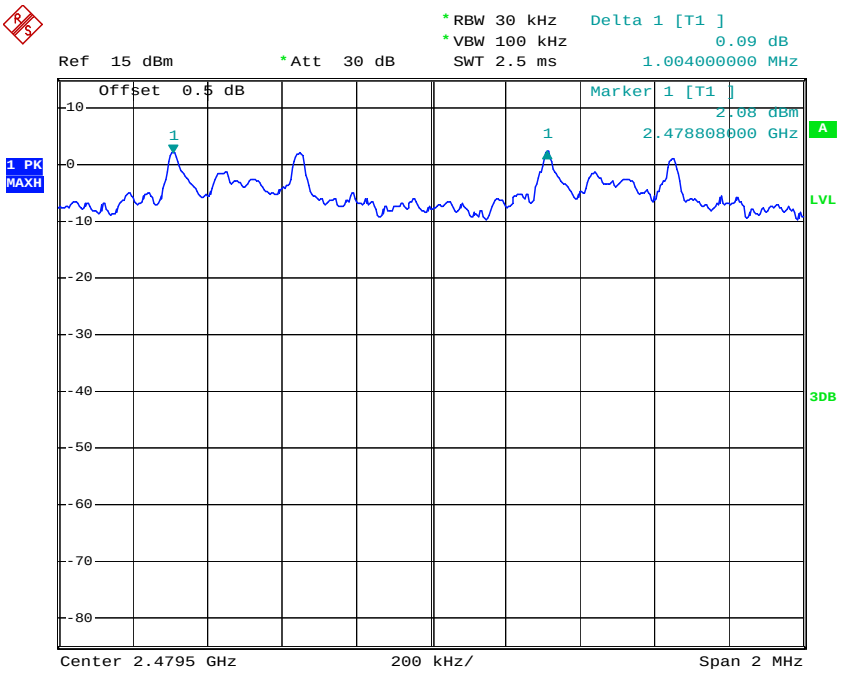
Low Channel



Middle Channel

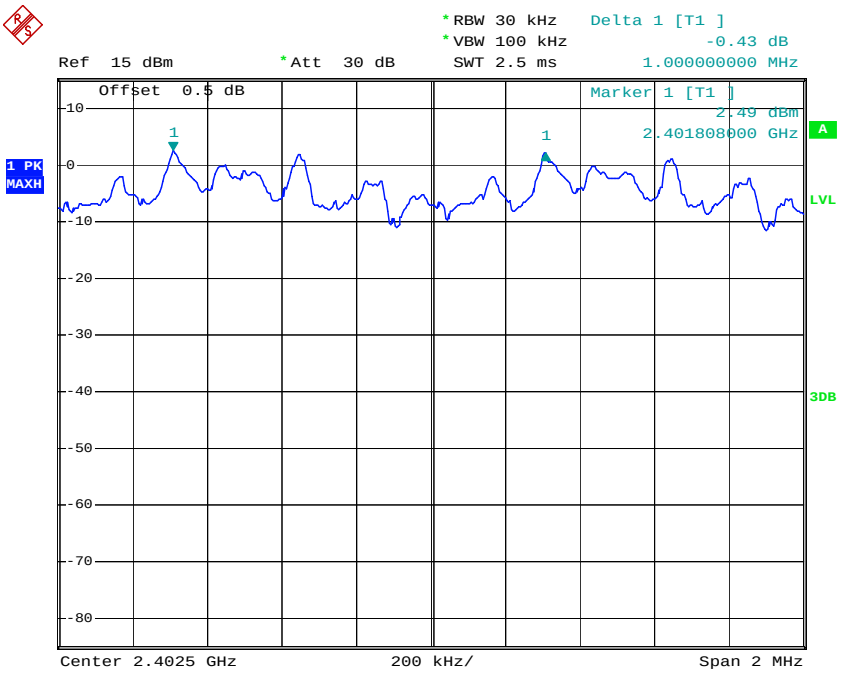


High Channel

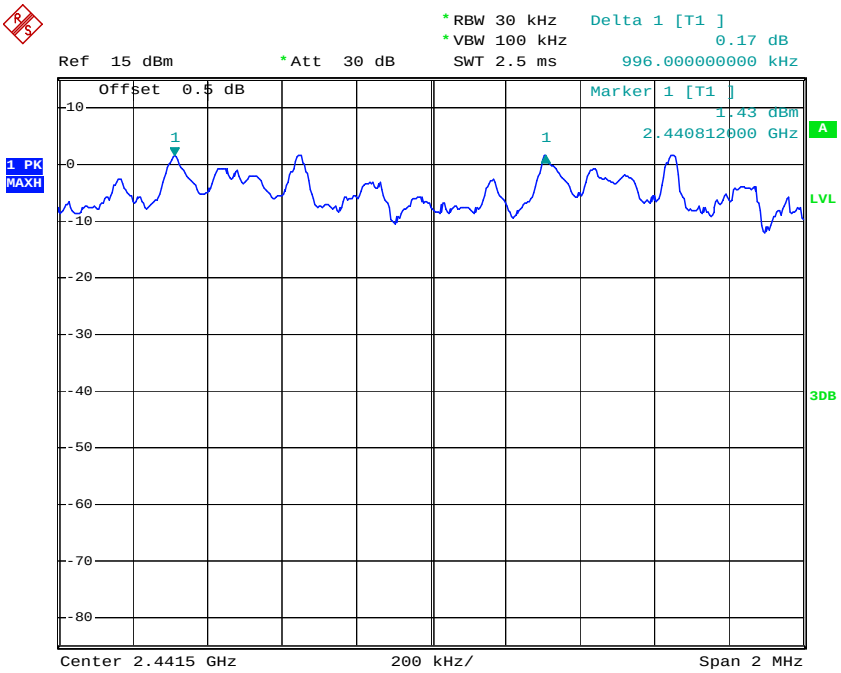


EDR Mode (8-DPSK):

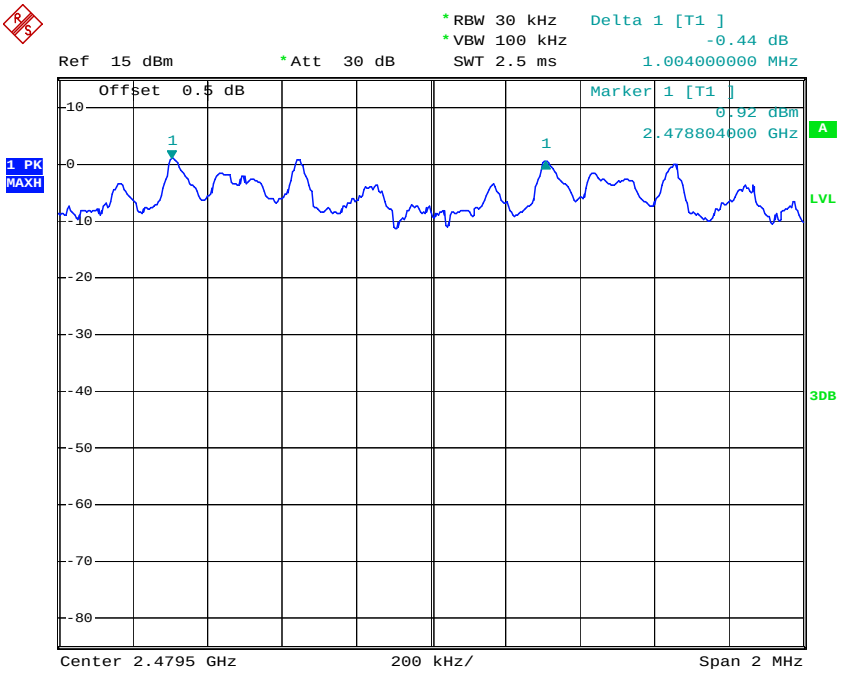
Low Channel



Middle Channel



High Channel



FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING

Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	30.1°C
Relative Humidity:	53 %
ATM Pressure:	100.2 kPa

** The testing was performed by Lion Xiao on 2016-07-26.*

Test Result: Compliance.

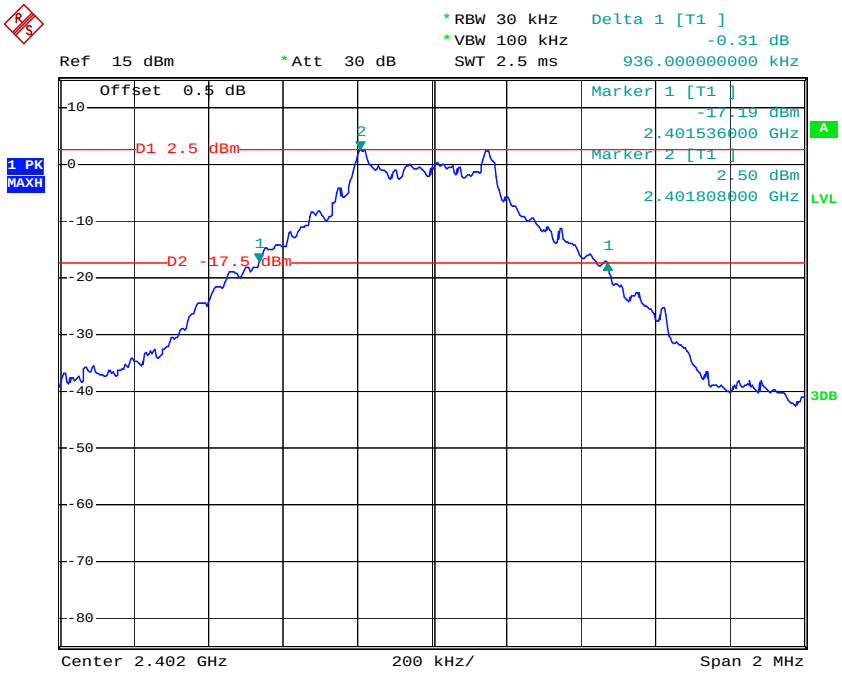
Please refer to following tables and plots

Test Mode: Transmitting

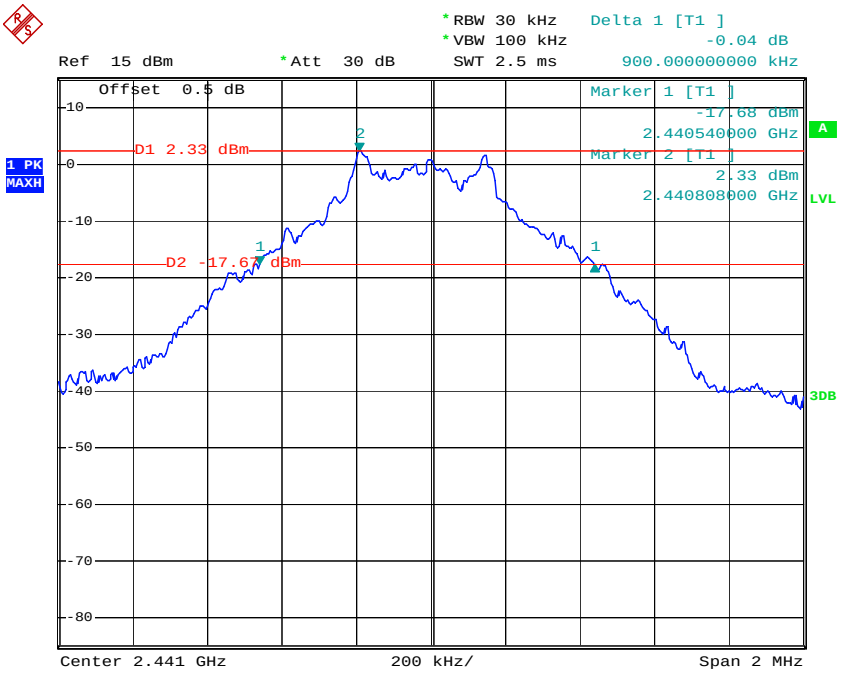
Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	0.936
	Middle	2441	0.900
	High	2480	0.888
EDR Mode (π/4-DQPSK):	Low	2402	1.230
	Middle	2441	1.230
	High	2480	1.230
EDR Mode (8-DPSK):	Low	2402	1.290
	Middle	2441	1.272
	High	2480	1.278

BDR Mode (GFSK):

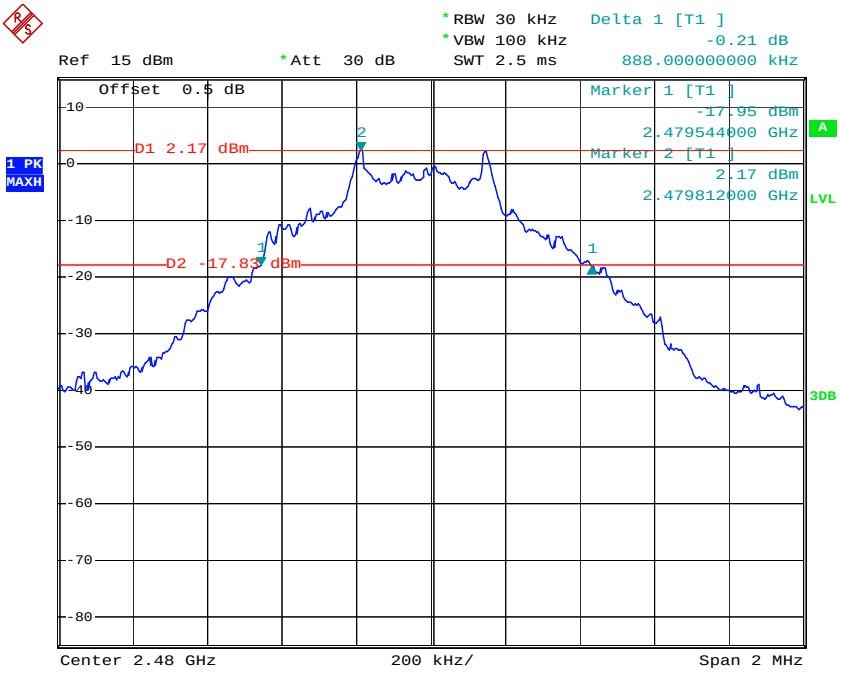
Low Channel



Middle Channel

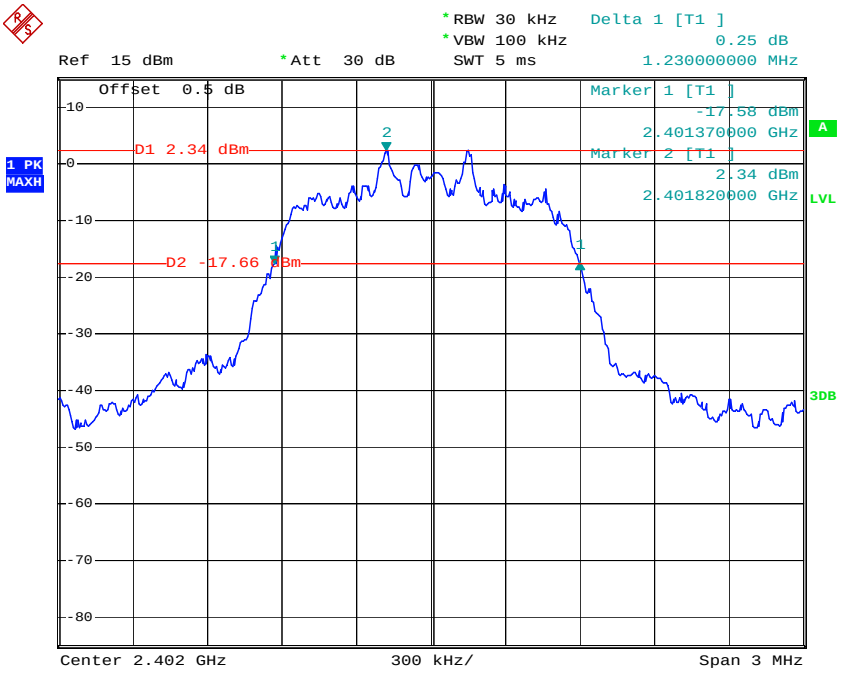


High Channel

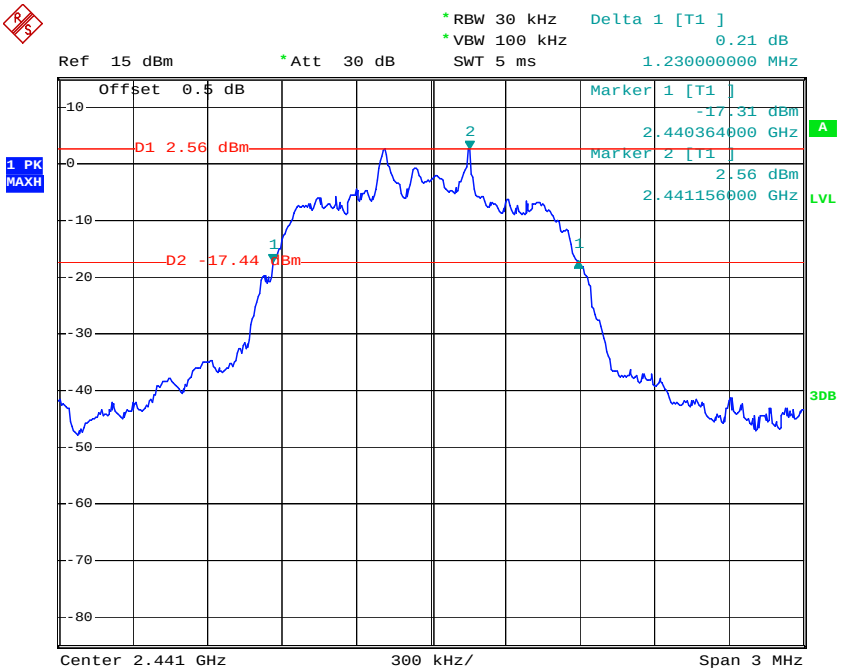


EDR Mode (π/4-DQPSK):

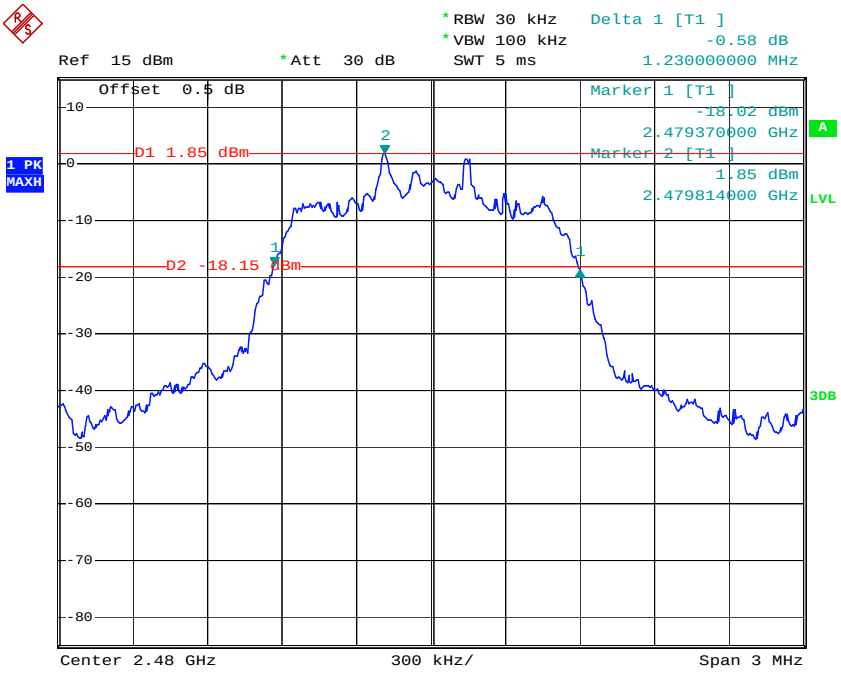
Low Channel



Middle Channel

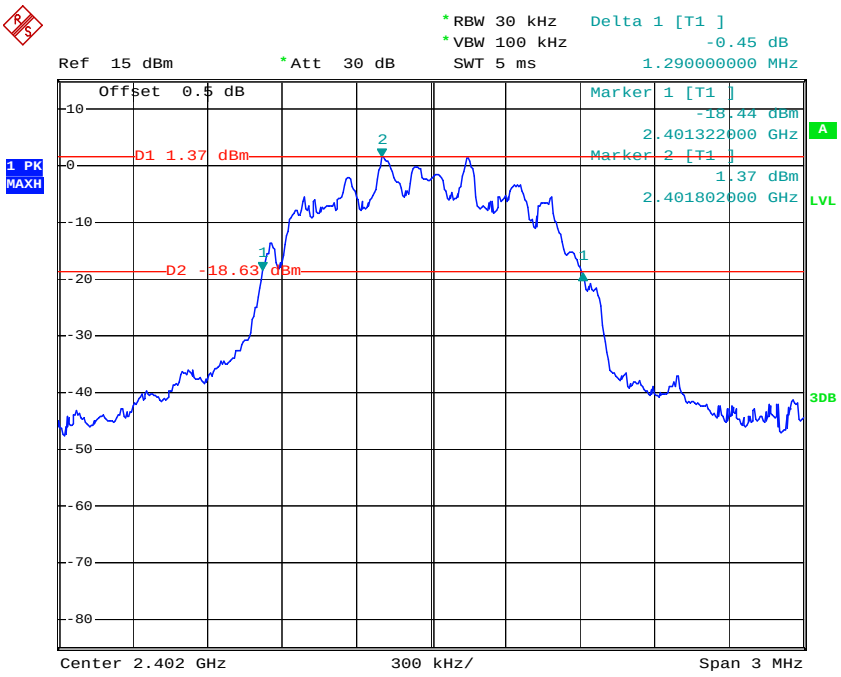


High Channel

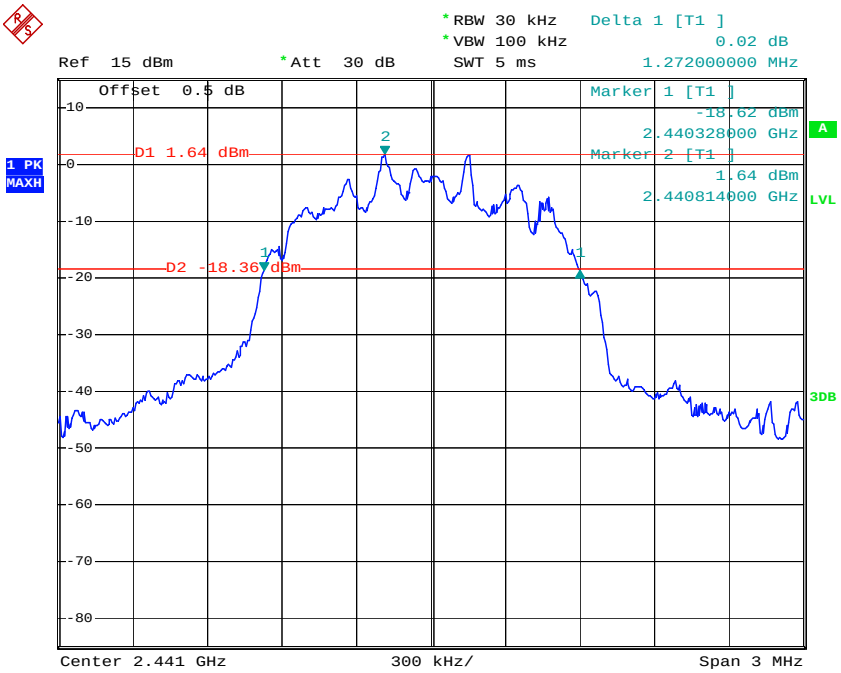


EDR Mode (8-DPSK):

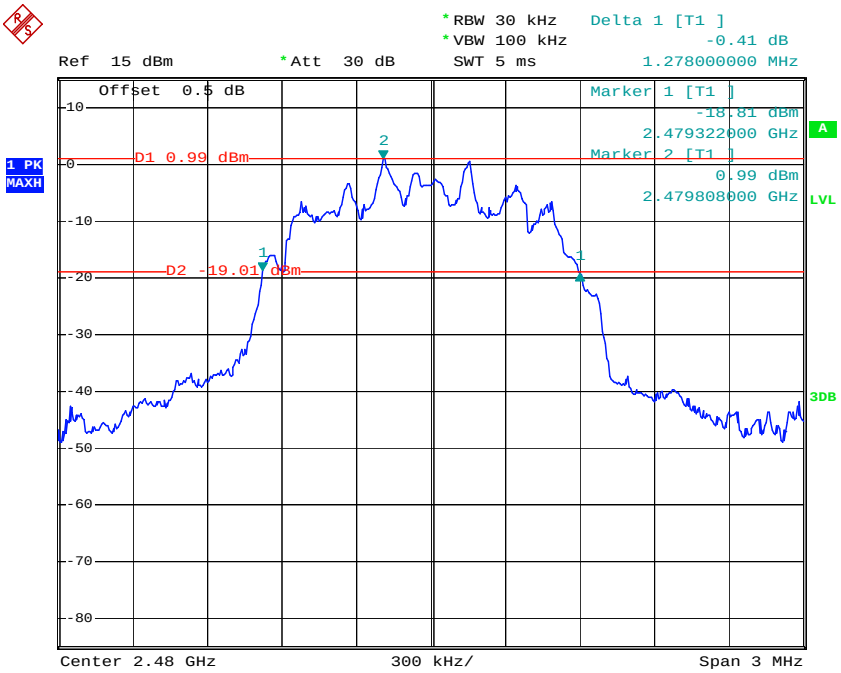
Low Channel



Middle Channel



High Channel



FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	31.2°C
Relative Humidity:	54 %
ATM Pressure:	100.2 kPa

** The testing was performed by Lion Xiao on 2016-07-27.*

Test Result: Compliance.

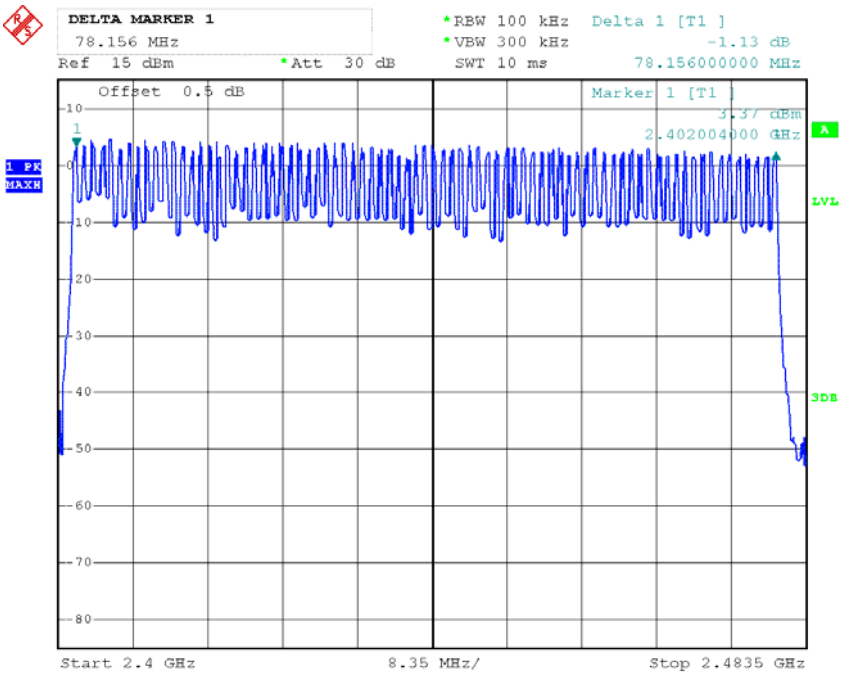
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	⩾15

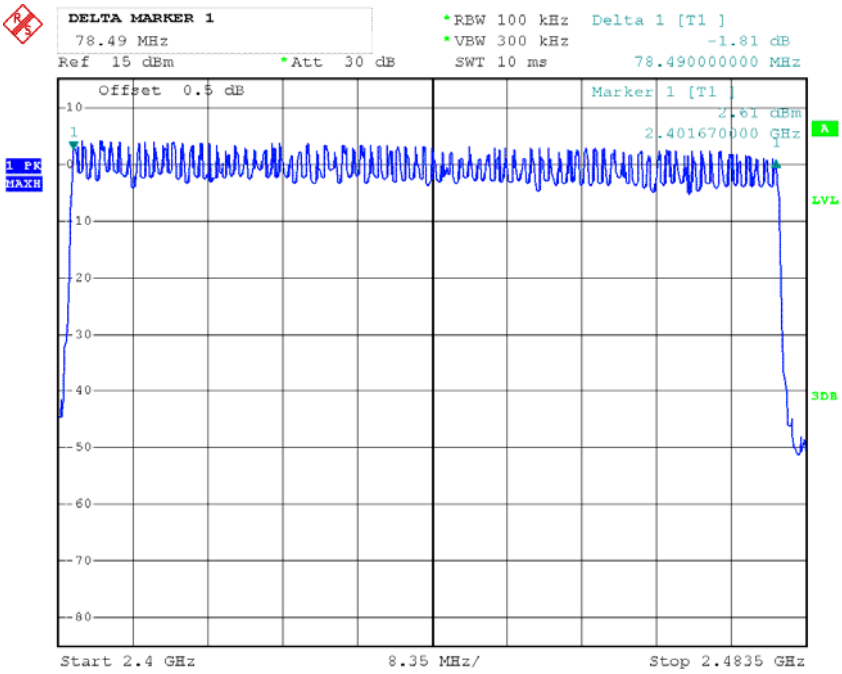
Number of Hopping Channels



EDR Mode (π/4-DQPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	⩾15

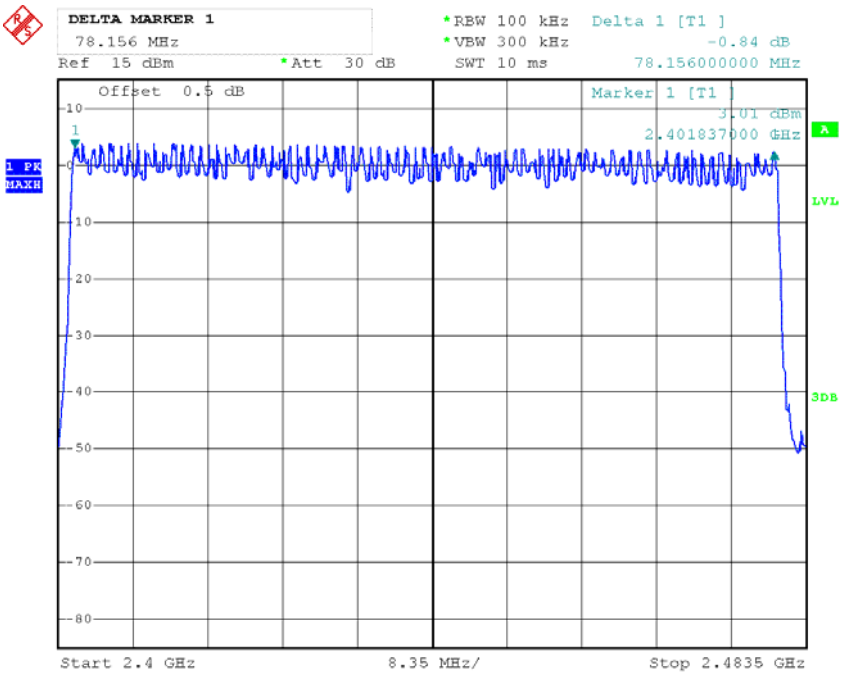
Number of Hopping Channels



EDR Mode (8-DPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15

Number of Hopping Channels



FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 * channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Dwell Time= time slot length * hope rate/ number of hopping channels * 31.6s
Hop rate=1600/s

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	31.2°C
Relative Humidity:	54 %
ATM Pressure:	100.2 kPa

** The testing was performed by Lion Xiao on 2016-07-27.*

Test Result: Compliance.

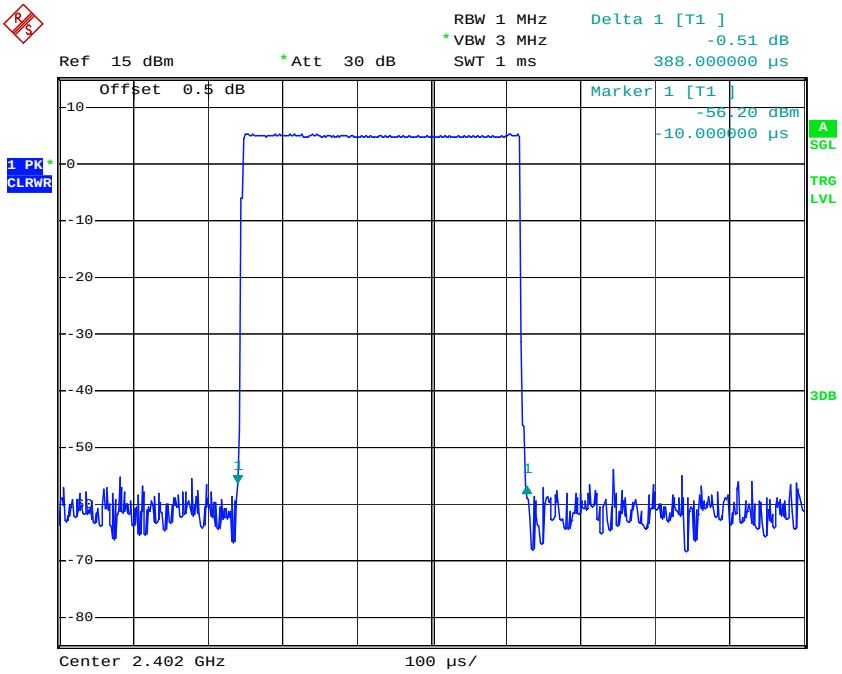
Please refer to following tables and plots

Test Mode: Transmitting

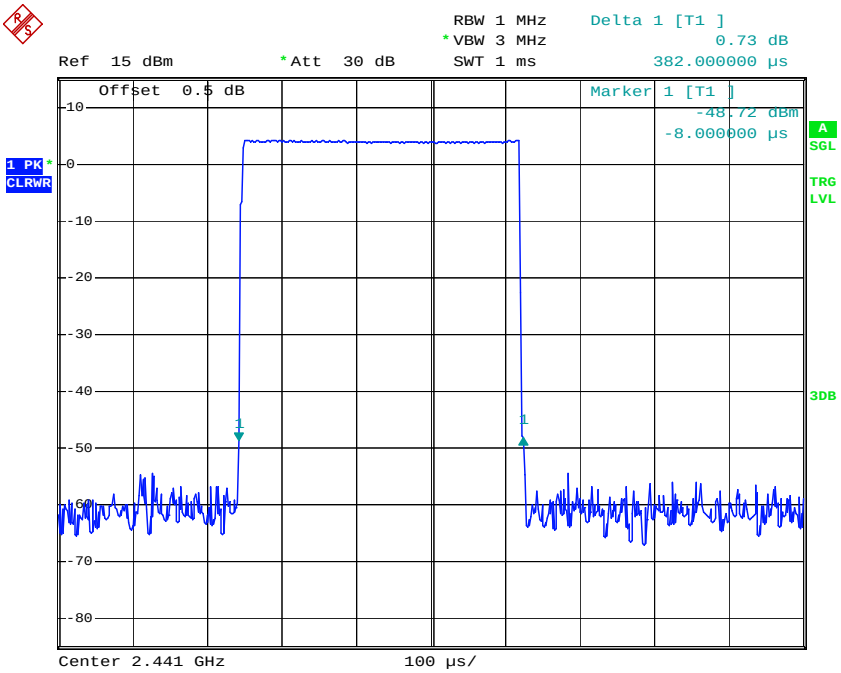
BDR Mode (GFSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.388	0.124	0.4	Compliance
	Middle	0.382	0.122	0.4	Compliance
	High	0.382	0.122	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.650	0.264	0.4	Compliance
	Middle	1.656	0.265	0.4	Compliance
	High	1.650	0.264	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.910	0.310	0.4	Compliance
	Middle	2.900	0.309	0.4	Compliance
	High	2.910	0.310	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

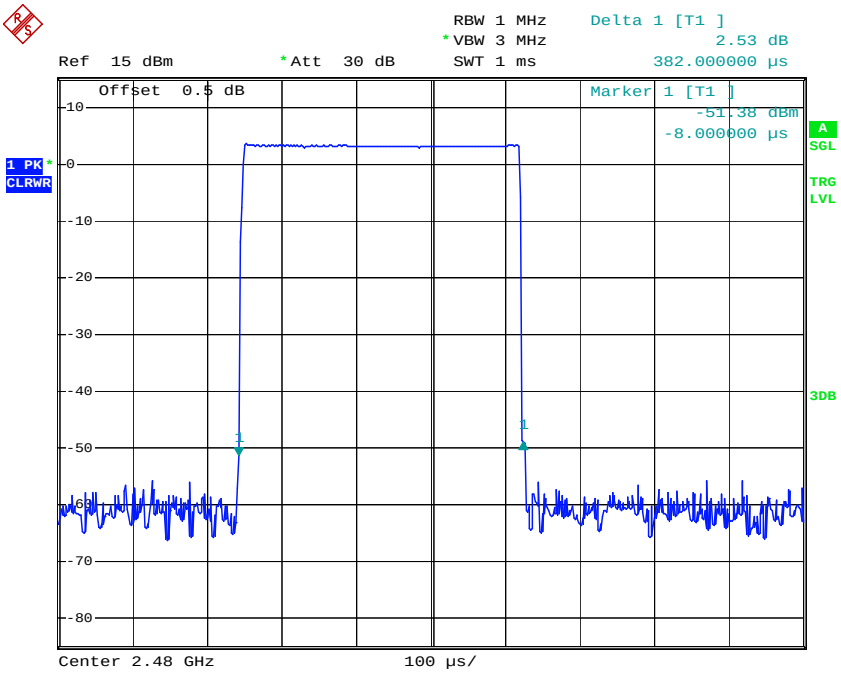
DH1: Low Channel



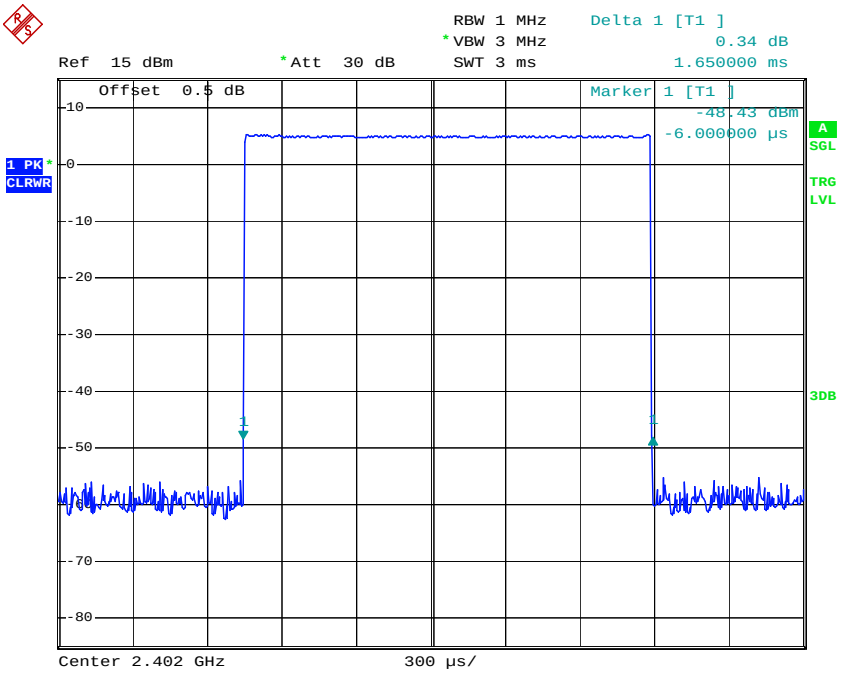
DH1: Middle Channel



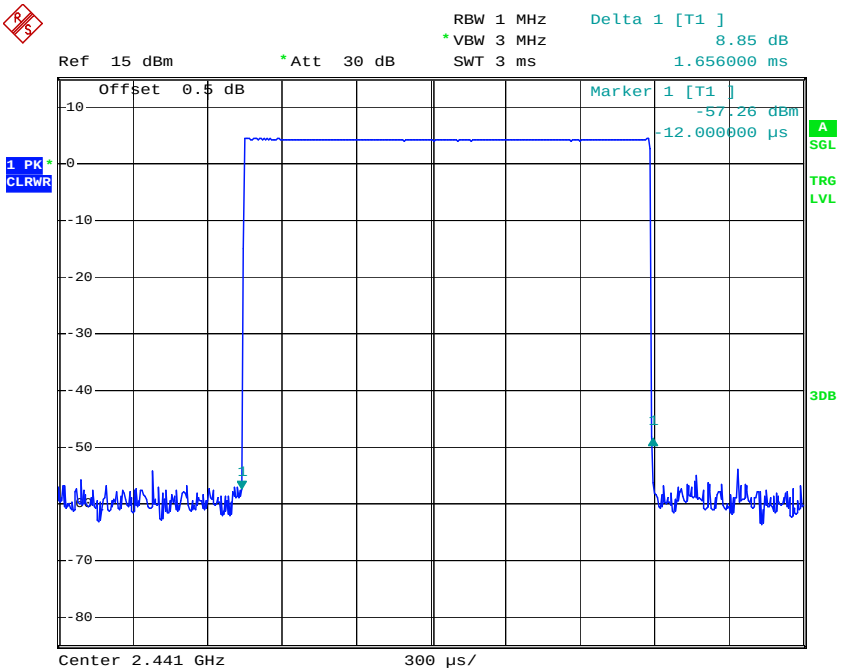
DH1: High Channel



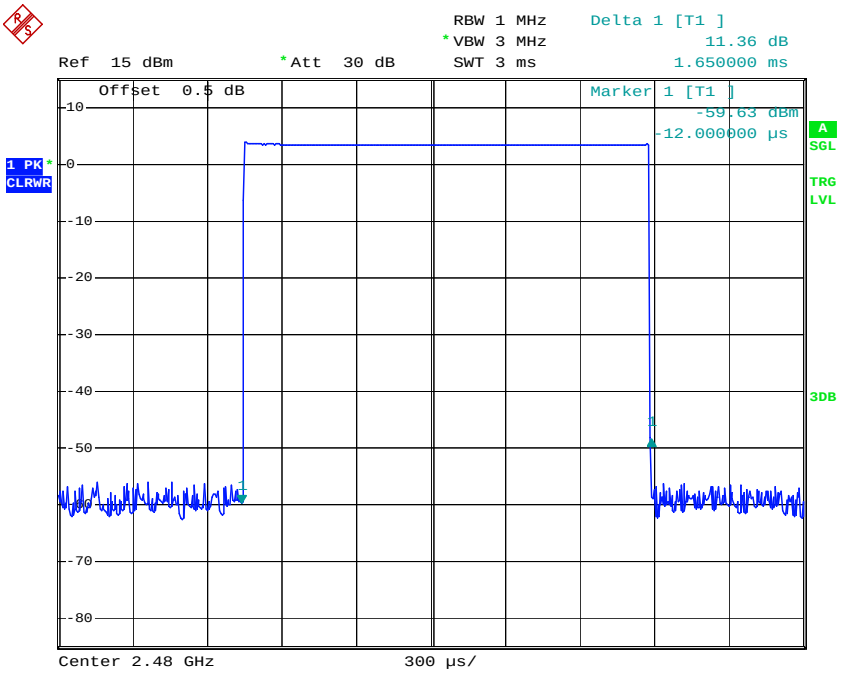
DH3: Low Channel



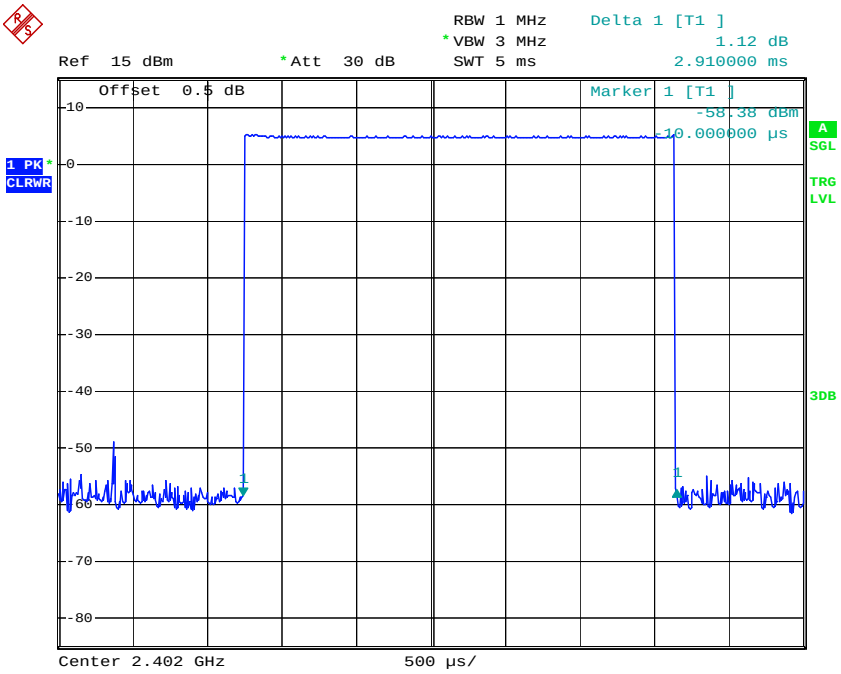
DH3: Middle Channel



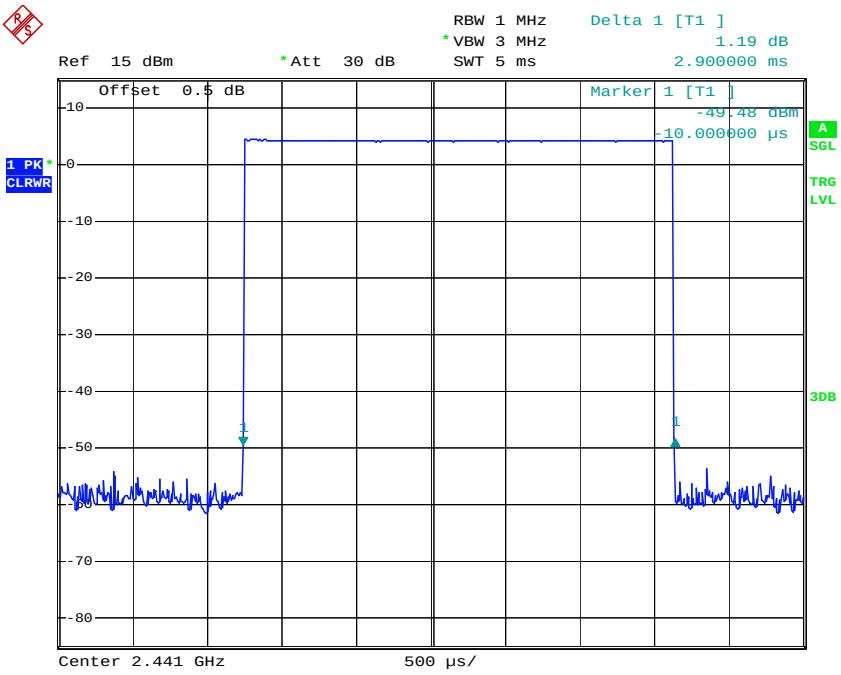
DH3: High Channel



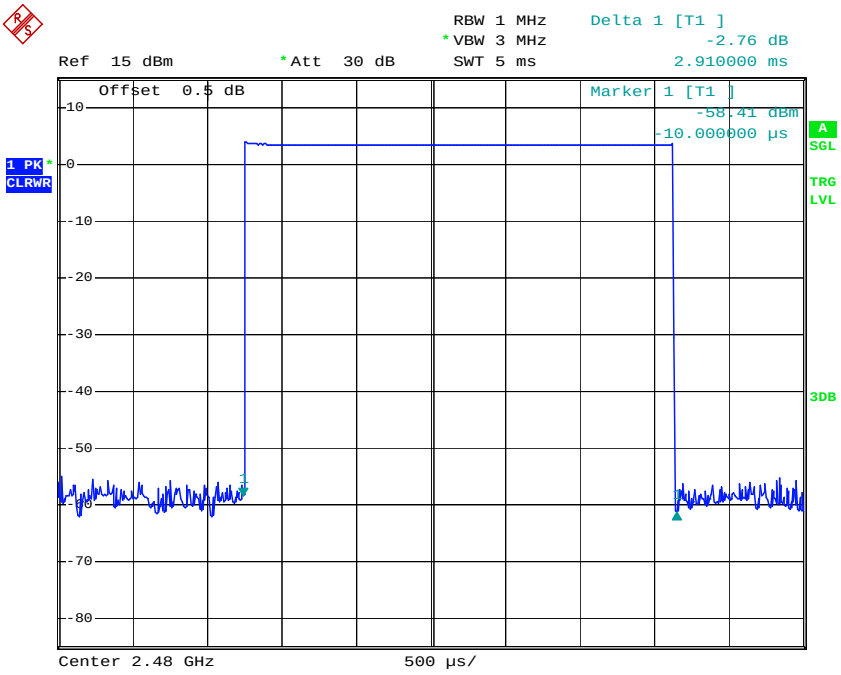
DH5: Low Channel



DH5: Middle Channel



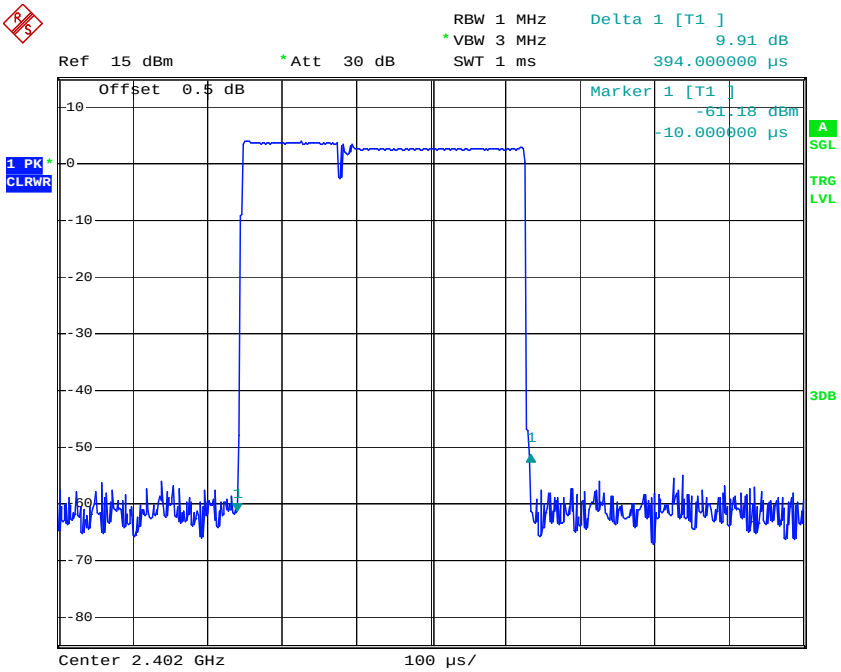
DH5: High Channel



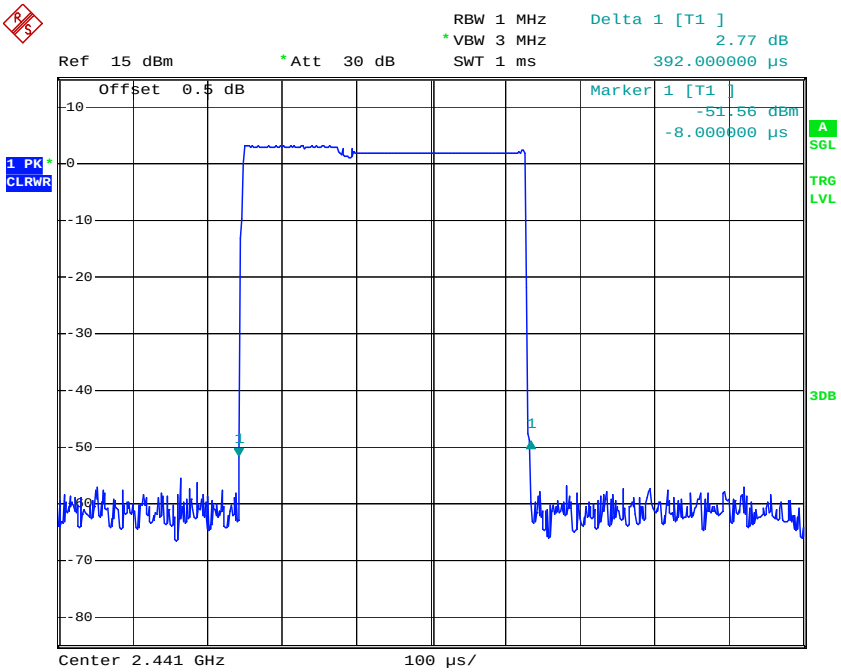
EDR Mode (π/4-DQPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	0.394	0.126	0.4	Compliance
	Middle	0.392	0.125	0.4	Compliance
	High	0.390	0.125	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
2DH3	Low	1.656	0.265	0.4	Compliance
	Middle	1.656	0.265	0.4	Compliance
	High	1.656	0.265	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
2DH5	Low	2.910	0.310	0.4	Compliance
	Middle	2.910	0.310	0.4	Compliance
	High	2.910	0.310	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

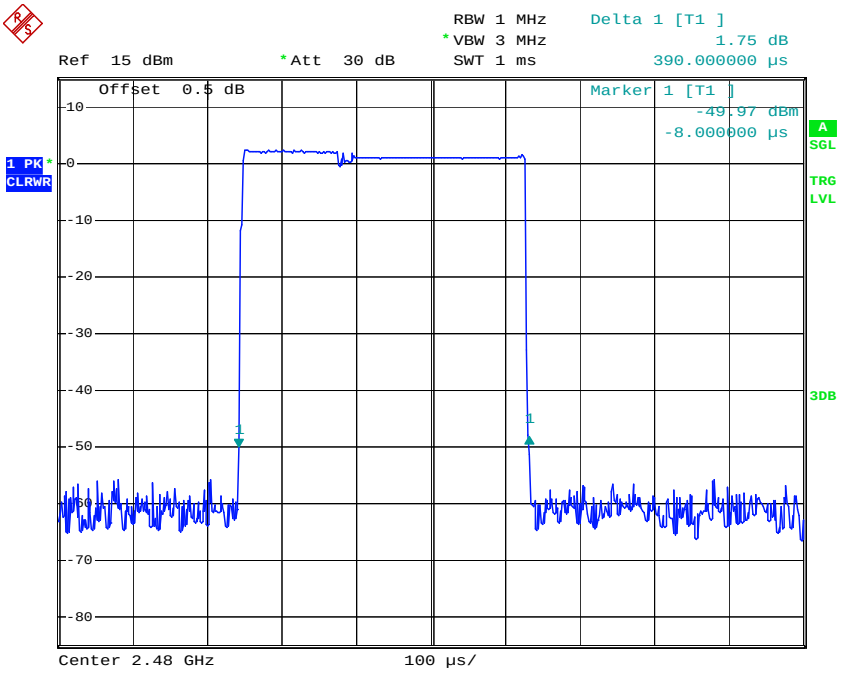
2DH1: Low Channel



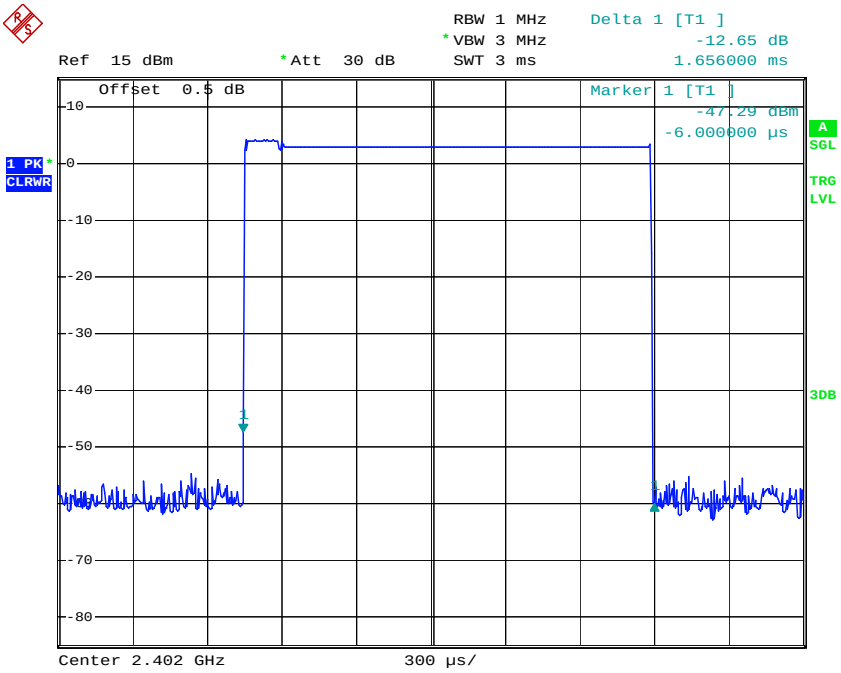
2DH1: Middle Channel



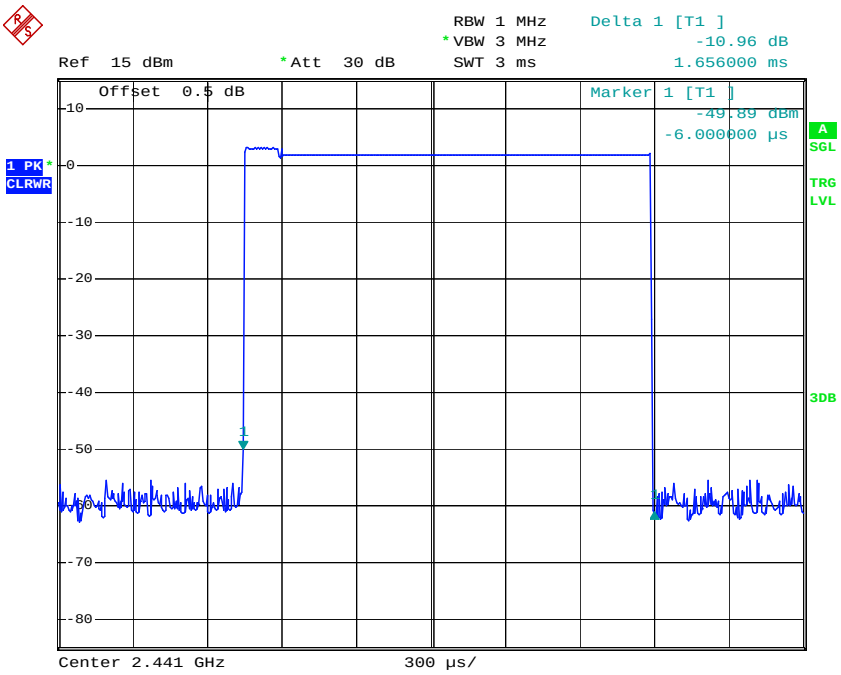
2DH1: High Channel



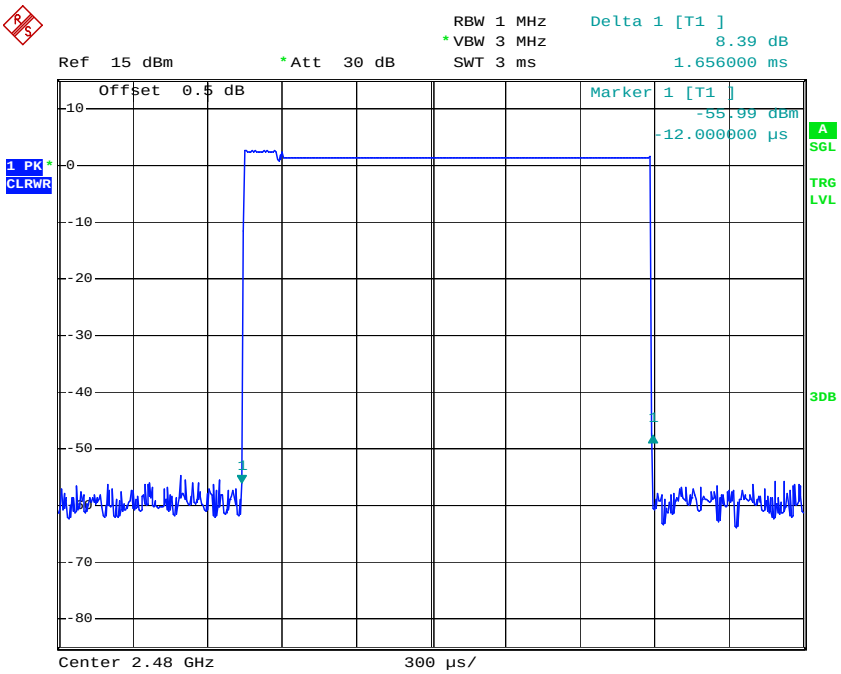
2DH3: Low Channel



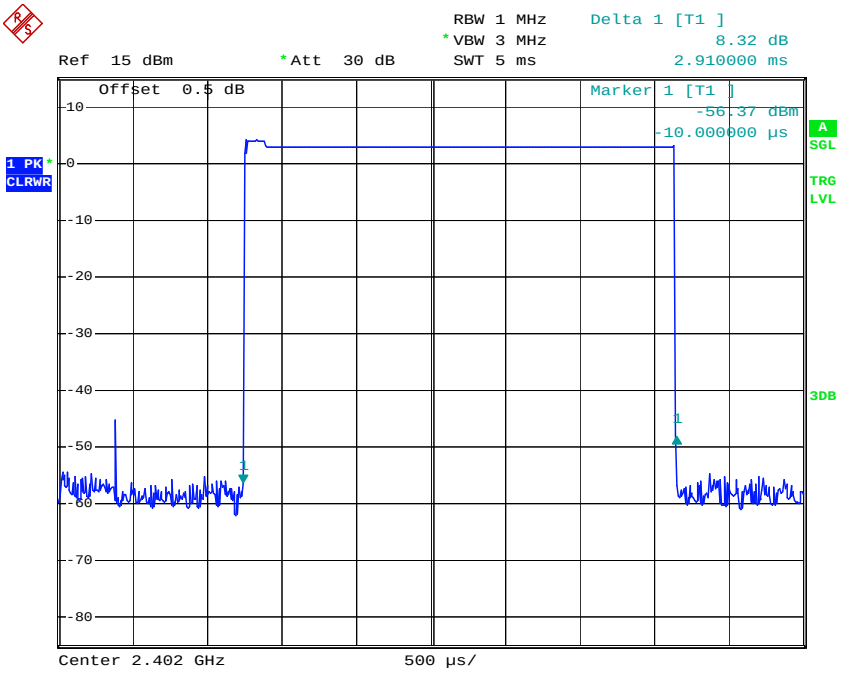
2DH3: Middle Channel



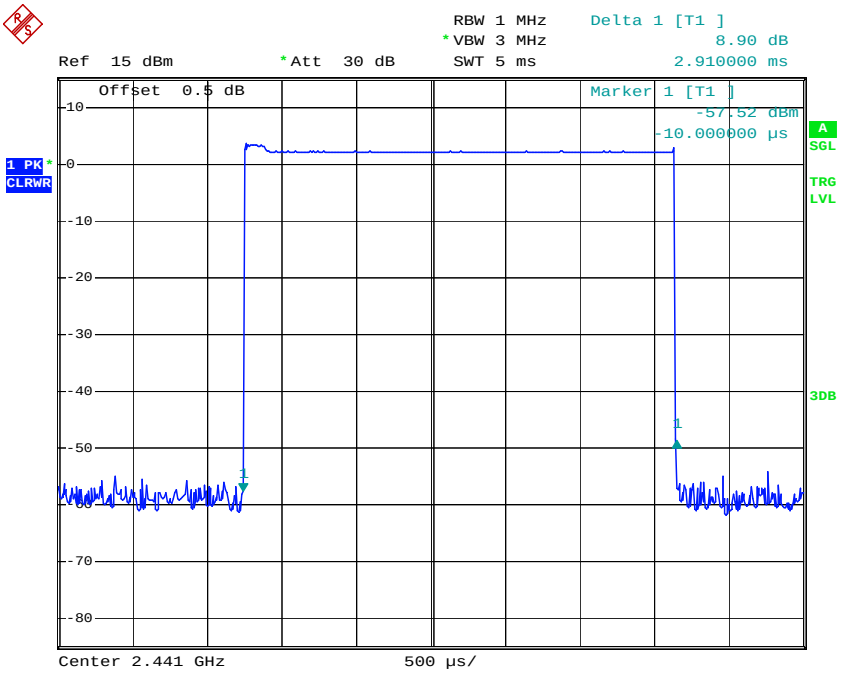
2DH3: High Channel



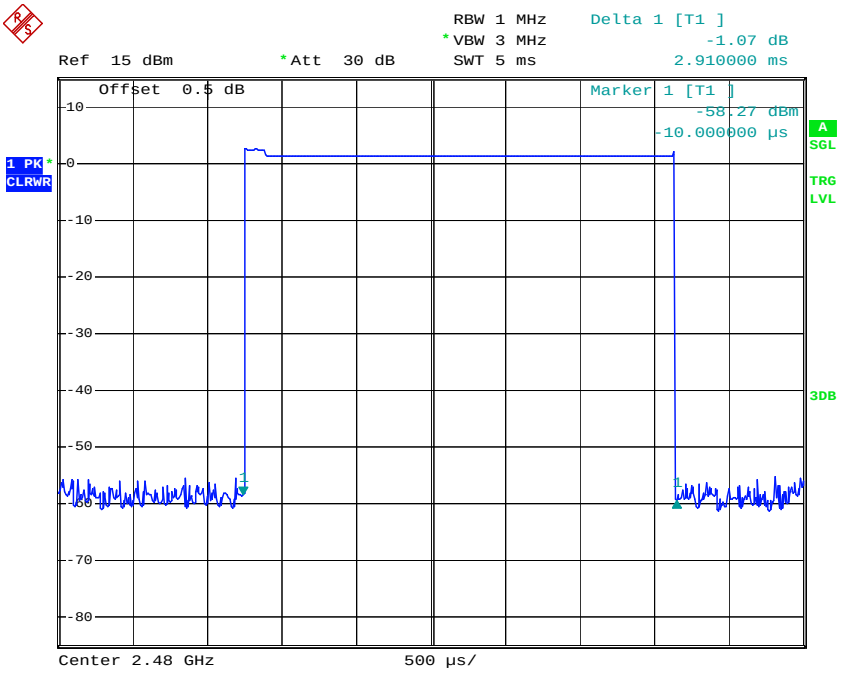
2DH5: Low Channel



2DH5: Middle Channel



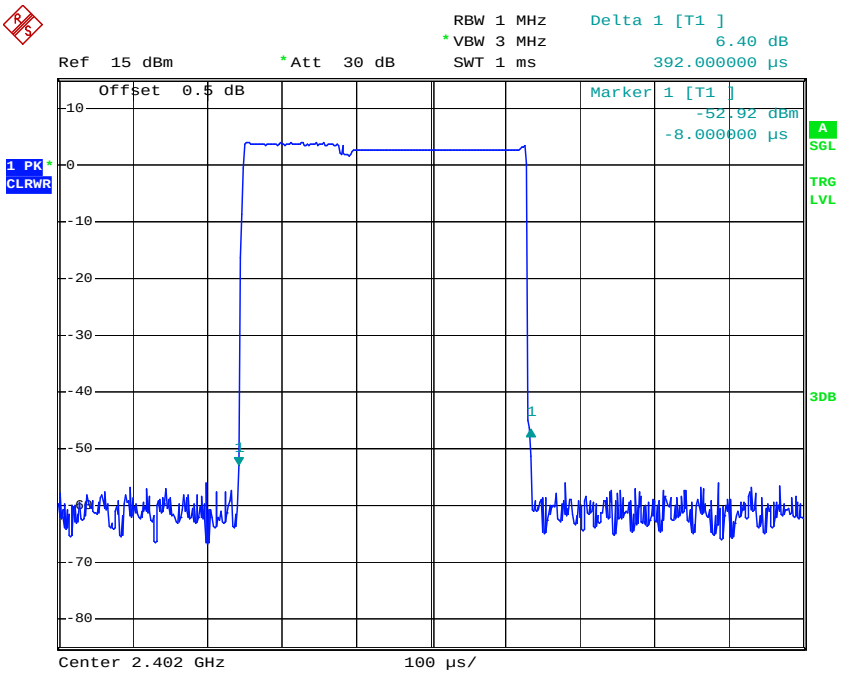
2DH5: High Channel



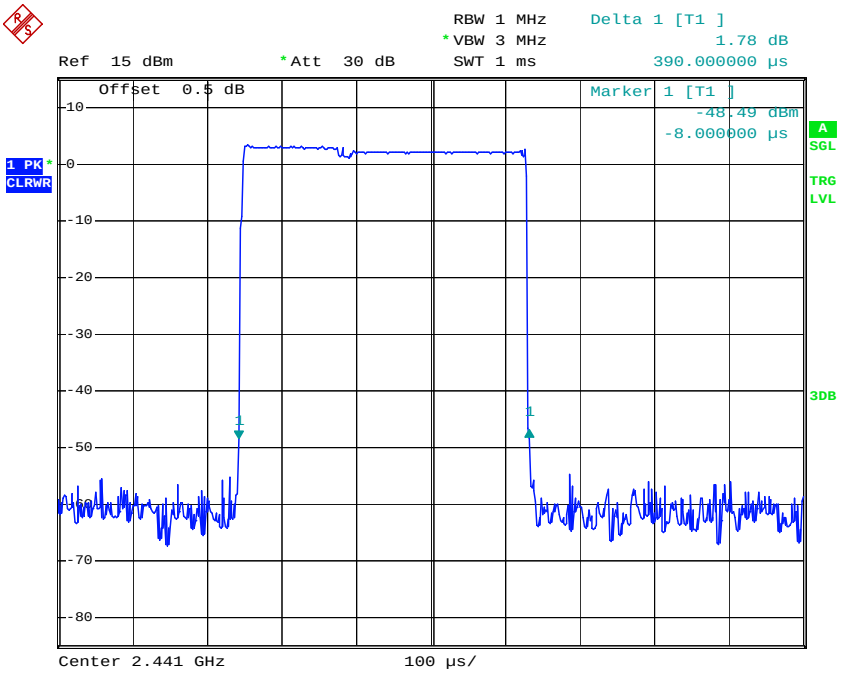
EDR Mode (8-DPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
3DH1	Low	0.392	0.125	0.4	Compliance
	Middle	0.390	0.125	0.4	Compliance
	High	0.390	0.125	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
3DH3	Low	1.656	0.265	0.4	Compliance
	Middle	1.656	0.265	0.4	Compliance
	High	1.656	0.265	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
3DH5	Low	2.920	0.311	0.4	Compliance
	Middle	2.910	0.310	0.4	Compliance
	High	2.920	0.311	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

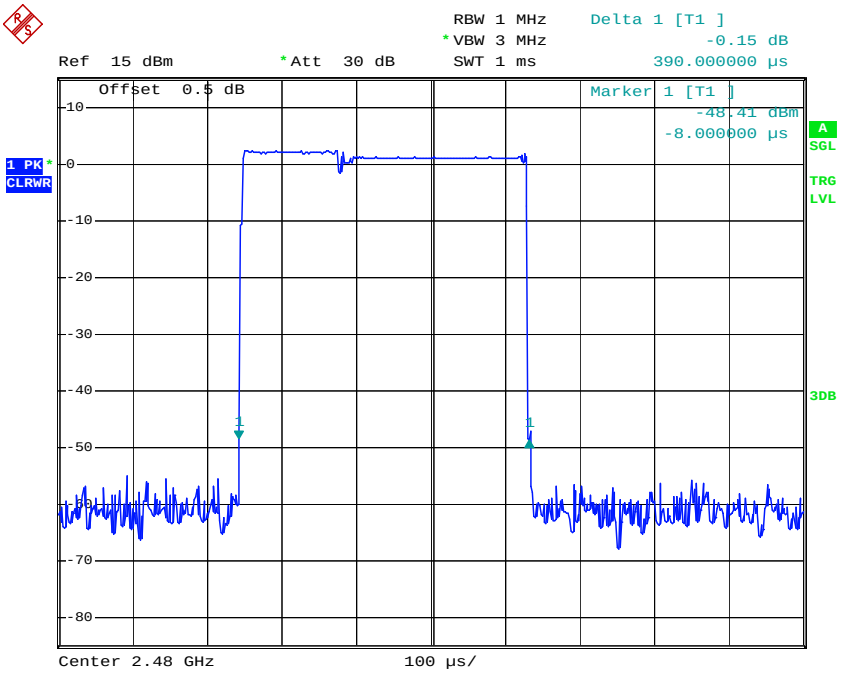
3DH1: Low Channel



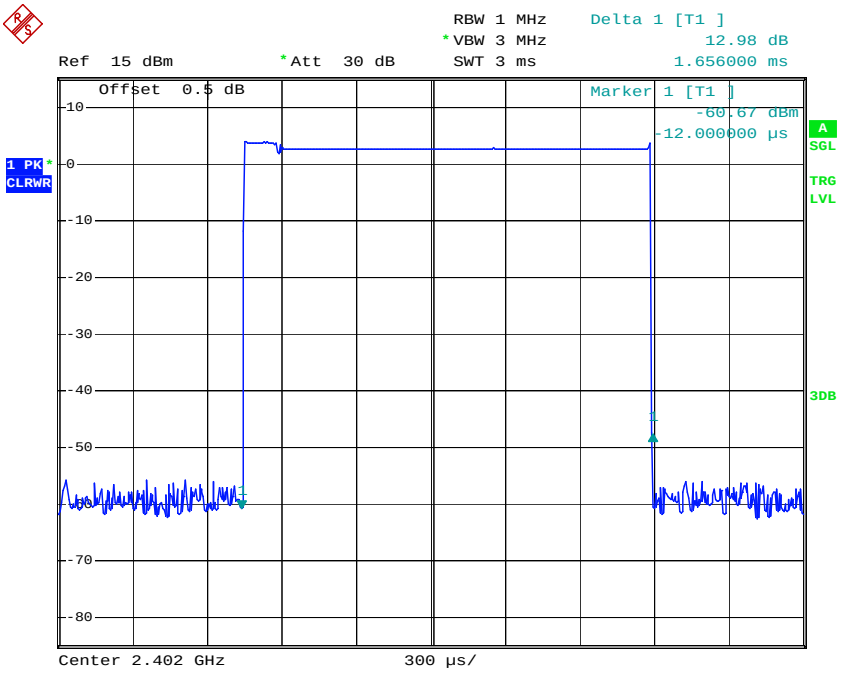
3DH1: Middle Channel



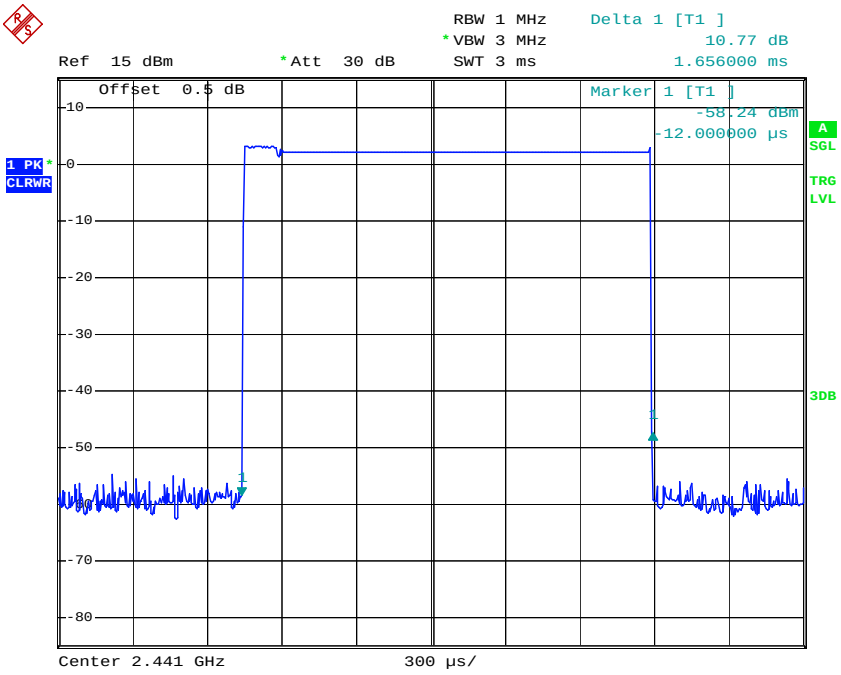
3DH1: High Channel



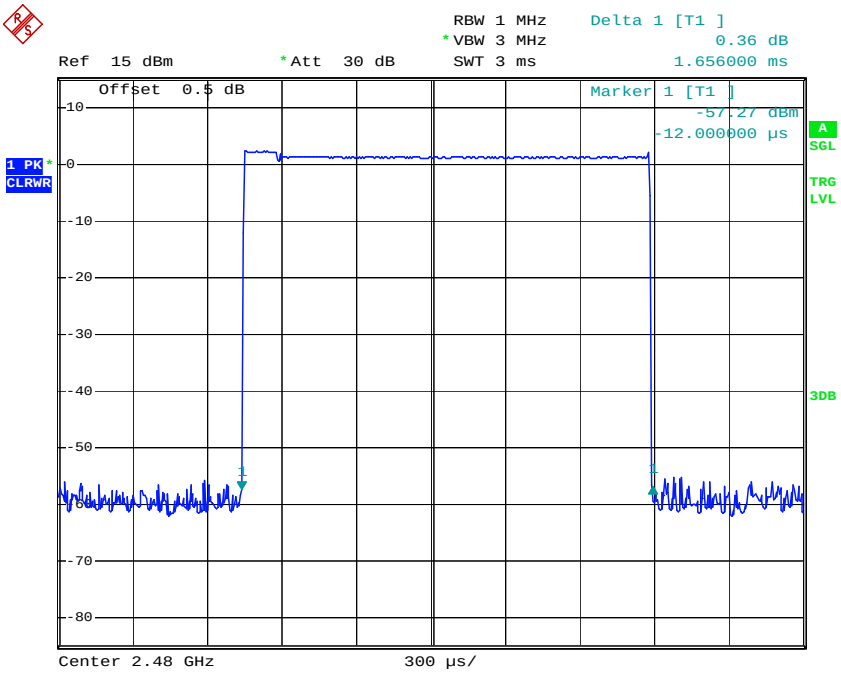
3DH3: Low Channel



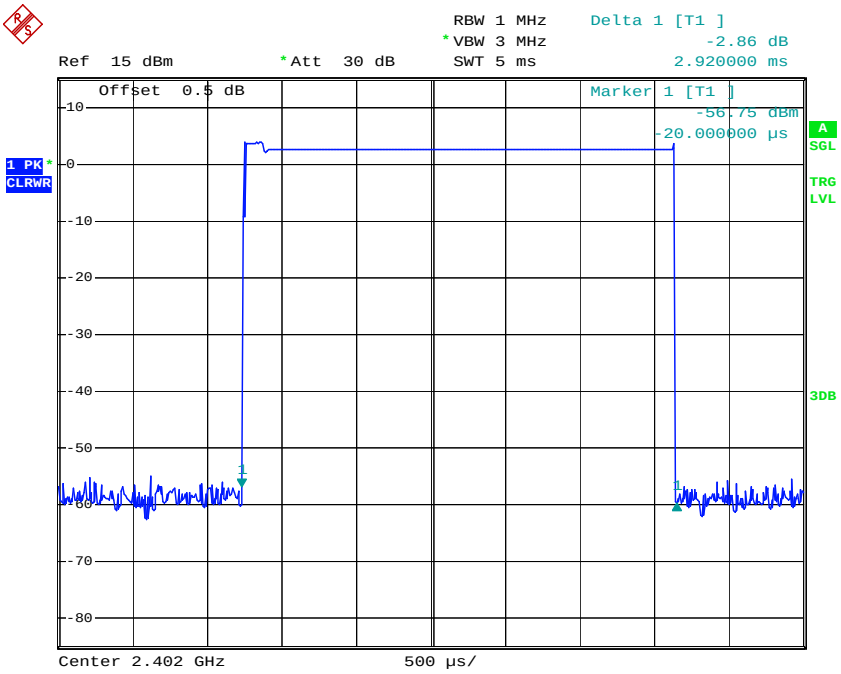
3DH3: Middle Channel



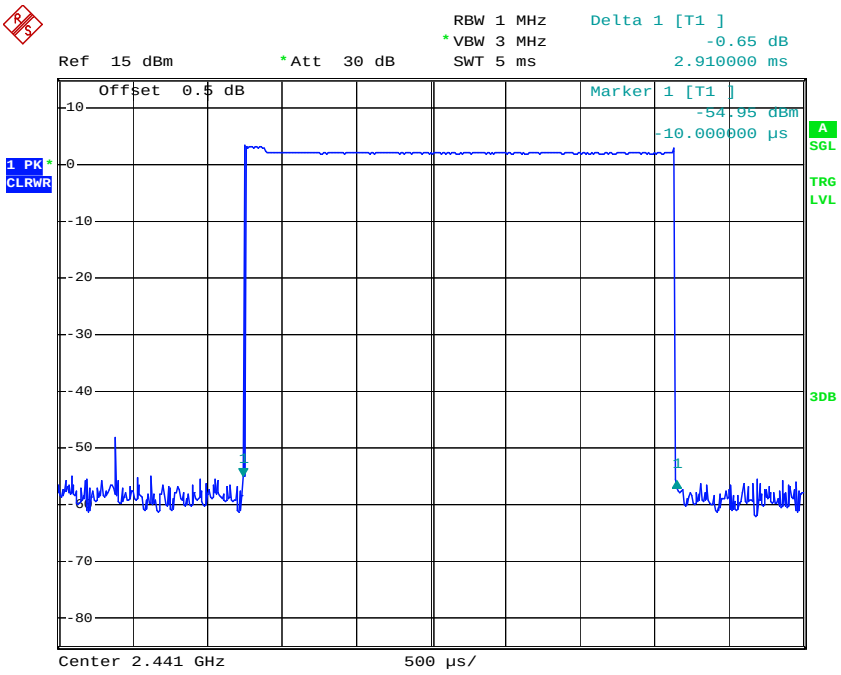
3DH3: High Channel



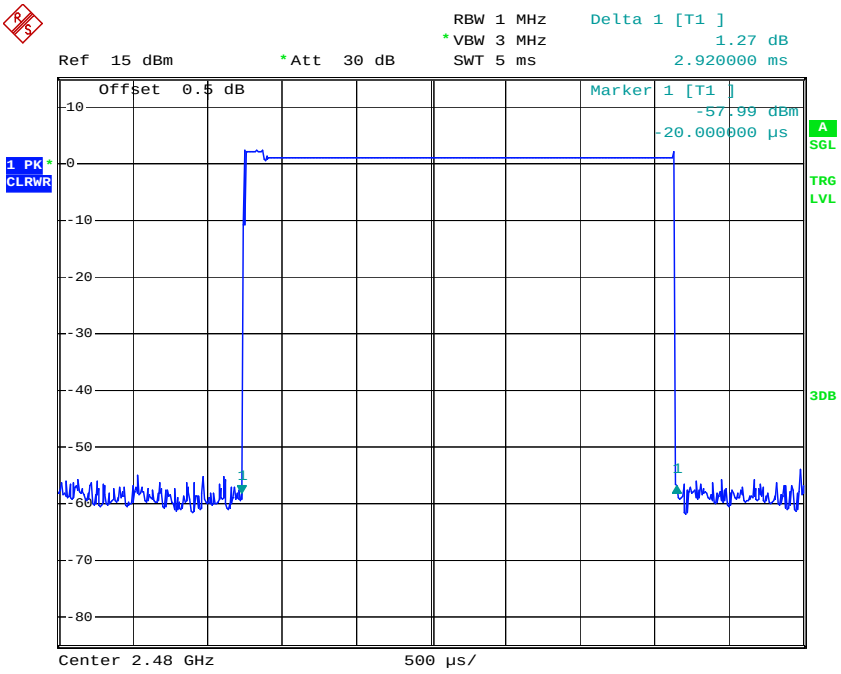
3DH5: Low Channel



3DH5: Middle Channel



3DH5: High Channel



FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	31.2°C
Relative Humidity:	54 %
ATM Pressure:	100.2 kPa

** The testing was performed by Lion Xiao on 2016-07-27.*

Test Result: Compliance.

Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	Low	2402	4.07	30
	Middle	2441	3.40	30
	High	2480	2.64	30
EDR Mode (π/4-DQPSK)	Low	2402	5.45	30
	Middle	2441	4.81	30
	High	2480	4.10	30
EDR Mode (8-DPSK)	Low	2402	5.66	30
	Middle	2441	5.11	30
	High	2480	4.47	30

Note: The data above was tested in conducted mode.

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

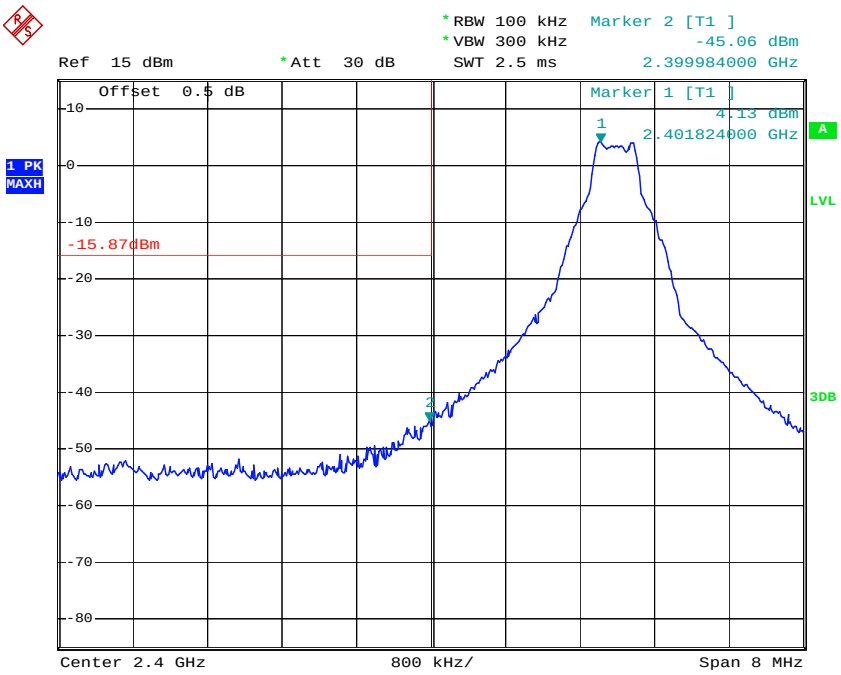
Temperature:	31.2°C
Relative Humidity:	54 %
ATM Pressure:	100.2 kPa

** The testing was performed by Lion Xiao on 2016-07-27.*

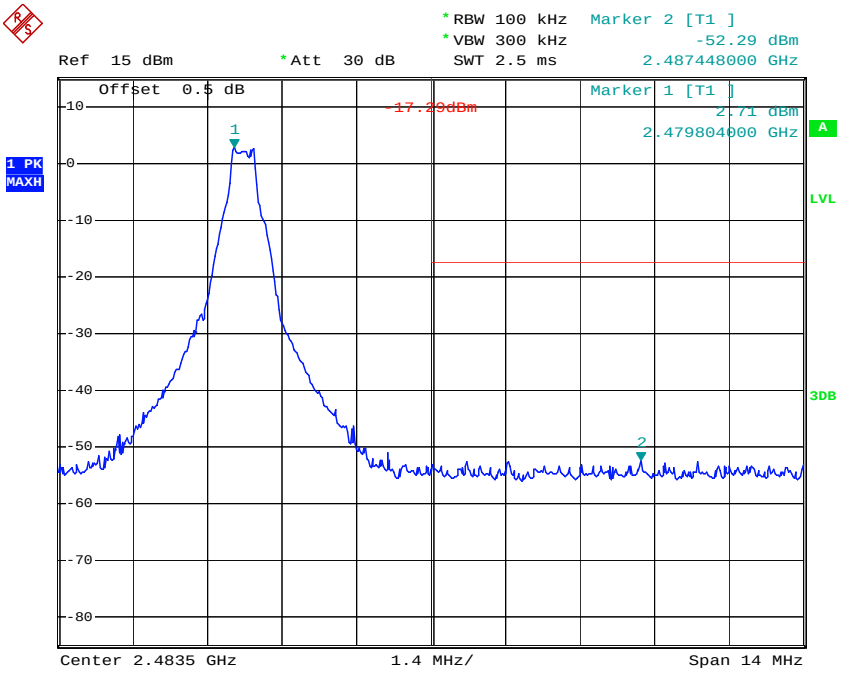
Test Result: Compliance

BDR Mode (GFSK):

Band Edge, Left Side

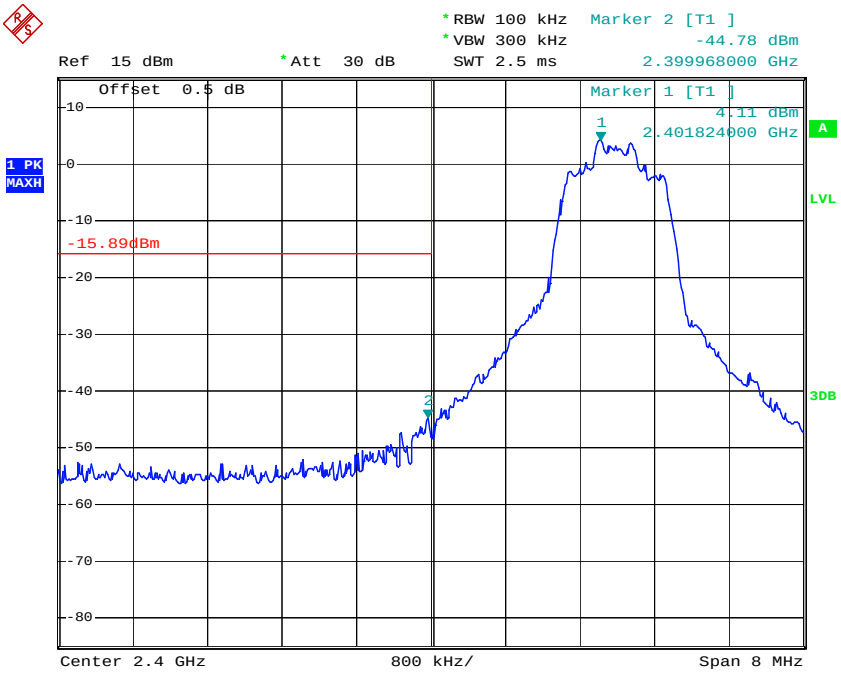


Band Edge, Right Side

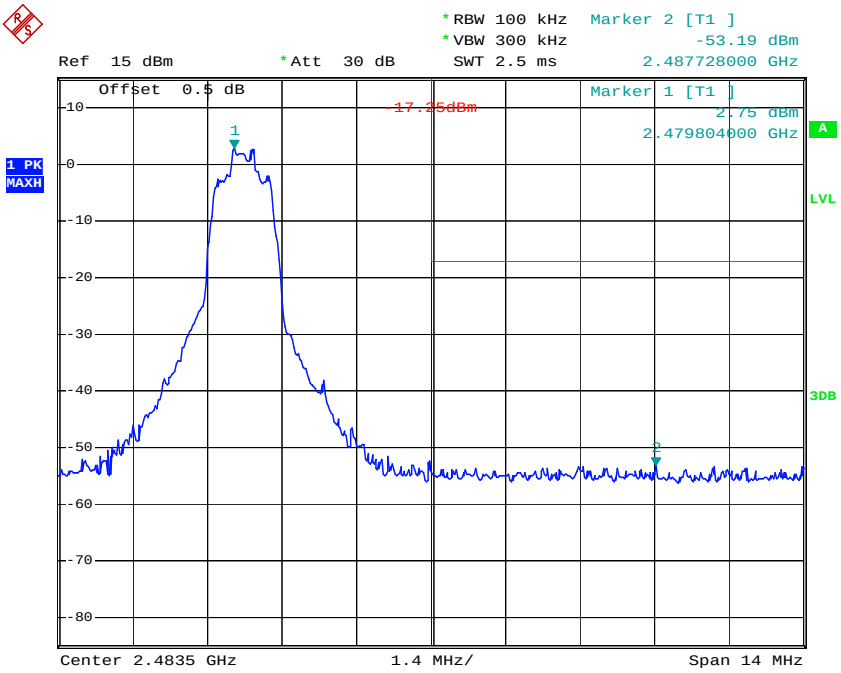


EDR Mode (π/4-DQPSK):

Band Edge, Left Side

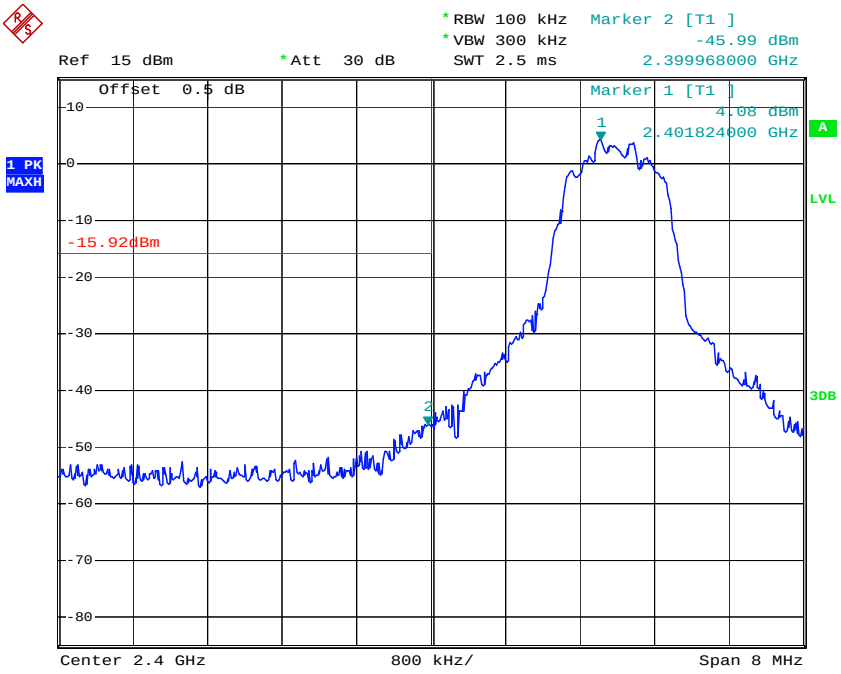


Band Edge, Right Side

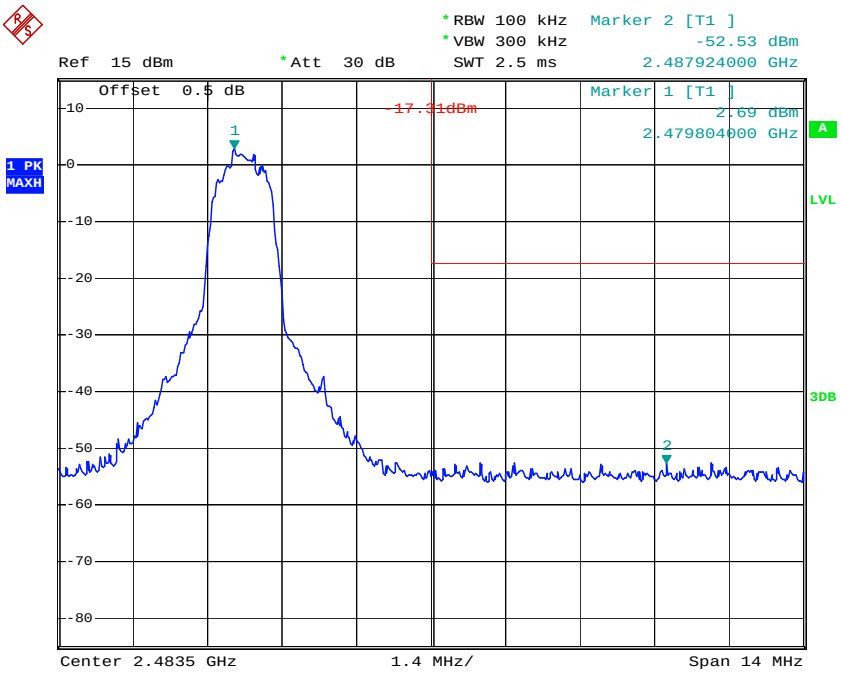


EDR Mode (8-DPSK):

Band Edge, Left Side



Band Edge, Right Side



*******END OF REPORT*******